RCS# 03-489

EGLIN AIR FORCE BASE
Florida

FINAL
ENVIRONMENTAL ASSESSMENT

EGLIN GULF TEST AND TRAINING RANGE (EGTTR) PRECISION STRIKE WEAPONS (PSW) TEST (FIVE-YEAR PLAN) EGLIN AIR FORCE BASE, FLORIDA

November 2005

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FINAL
FINDING OF NO SIGNIFICANT IMPACT
FOR
Precision Strike Weapons (PSW) Test (Five-Year Plan)
EGLIN GULF TEST AND TRAINING RANGE, EGLIN AFB, FLORIDA
RCS 03-489

Pursuant to the President's Council on Environmental Quality regulations for implementing the procedural provisions of the National Environmental Policy Act (40 Code of Federal Regulations [CFR]1500-1508), 32 CFR Part 989, and Department of Defense Directive 6050.1, the Department of the Air Force has conducted an Environmental Assessment (EA) of the probable environmental consequences for the Precision Strike Weapons (PSW) Test (Five-Year Plan) in the Eglin Gulf Test and Training Range (EGTTR), Eglin AFB, Florida.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Proposed Action: The proponent, the 46th Test Wing Precision Strike Division (46/OGMTP), proposes to conduct a series of PSW test missions during the next five years utilizing resources within the Eglin Military Complex, including two sites in the EGTTR. The weapons to be tested are the Joint Air–to-Surface Stand-Off Missile (JASSM) AGM-158 A and B, and the Small-Diameter Bomb (SDB) GBU-39/B. As many as 1 live and 4 inert JASSM missiles and 6 live and 12 inert SDBs per year would be launched from an aircraft above the Gulf of Mexico (GOM) at a target located more than 16 nautical miles (NM) offshore of Eglin Air Force Base. The test sites are depicted in the EA at Figure 1-1. The EGTTR encompasses Eglin controlled airspace overlying 124,031 square miles (mi^2) of the Gulf of Mexico waters. Eglin AFB is located in the Florida Panhandle between Pensacola and Panama City and is bordered on the south by the Gulf of Mexico.

The main objective of the test is to enable the Precision Strike Division to verify key/critical performance parameters, including missile integration and employment, mission planning, weapon lethality, and other system performance specifications for the JASSM and SDB. Both live and inert weapons will be tested. Under the proposed action, 1 live and 4 inert JASSM shots and 6 live and up to 12 inert SDB shots would occur. The need to establish PSW capabilities in the EGTTR is related to three main objectives: (1) planning and PSW system evaluations under differing scenarios, (2) establishment of a multi-year investigation of the PSW test and, (3) establishment of a large stand-off missile footprint, which is possible in the EGTTR. Testing is anticipated to occur several times per year for five years. The test would be conducted at two target locations; one located more than 16 NM offshore of Destin and another located more than 25 NM offshore of Test Area D-3 at Cape San Blas near Apalachicola.

Alternative Action: Alternative 1 would be identical to the Proposed Action except for the addition of two additional live JASSM shots, which would occur simultaneously at the target location.

This increased intensity of the JASSM shots would fulfill 46/OGMTP test objectives for simultaneous impacts (ripple effect) identified above.

No Action Alternative: The No Action Alternative would be to not test the PSWs in the EGTTR.

ANTICIPATED ENVIRONMENTAL EFFECTS

Anticipated environmental effects involving biological and cultural resources, water quality, geology, restricted access/socioeconomics, airspace, noise, and safety and occupational health are discussed in Chapter 4 of the EA. Environmental analysis identified no significant impacts to human health or the environment. Consultation with the National Marine Fisheries Service (NMFS) for a Letter of Authorization (LOA) take permit for potential mortality, injury, and harassment of marine mammals is required. A one-year Incidental Harassment Authorization (IHA) to take marine mammals by harassment has been obtained and allows for live testing to occur while the LOA is completed. A Biological Opinion (BO) required through the Section 7 Endangered Species Act Consultation process has been issued by NMFS. The BO addresses potential takes of threatened and endangered species and provides management practices that have been incorporated into this EA.

MANAGEMENT REQUIREMENTS

Management requirements are described in Chapter 5 of the EA. The need for these requirements was identified by the environmental analysis and was developed through cooperation between the proponent and the interested parties involved in the Proposed Action.

FINDING OF NO SIGNIFICANT IMPACT

Based on my review of the facts and the EA, I conclude that the proposed PSW Test (Five-Year Plan) on Eglin Test and Training Range, Florida, will not have a significant adverse impact of a long-term nature to the quality of the human or natural environment. This analysis fulfills the requirements of the National Environmental Policy Act, the President's Council on Environmental Quality regulations, and 32 CFR 989. Therefore an environmental impact statement is not required and will not be prepared.

TIMOTHY P. GAFFNEY, Colonel, USAF
Commander, 96th Civil Engineer Group

14 Dec 05
Date

FINAL
ENVIRONMENTAL ASSESSMENT

EGLIN GULF TEST AND TRAINING RANGE (EGTTR) PRECISION STRIKE WEAPONS (PSW) TEST (5-YEAR PLAN) EGLIN AIR FORCE BASE, FLORIDA

Prepared for:

DEPARTMENT OF THE AIR FORCE
Eglin Air Force Base, Florida

RCS# 03-489

November 2005

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LIST OF ACRONYMS AND ABBREVIATIONS

μg/L	Micrograms per Liter
μPa^2	Square MicroPascals
325^{th} FW	325^{th} Fighter Wing
46 OG/OGMTA	Precision Strike Branch
46 TW/XPE	46^{th} Test Wing Range Environmental Planning Office
96 CEG/CEVH	96^{th} Civil Engineer Group, Cultural Resources Branch
96 CEG/CEVSP	96^{th} Civil Engineer Group, Environmental Analysis Section
A/S	Air-to-Surface
AAC	Air Armament Center
AAC/SEOG	Eglin Ground Safety Office
AAC/SEU	Eglin Range Safety Office
AAC/YV	Precision Strike Program Office
AACI	AAC Instruction
ACMI	Air Combat Maneuvering Instrumentation
AF	Air Force
AFB	Air Force Base
AFI	Air Force Instruction
AFOSH	Air Force Occupational and Environmental Safety, Fire Protection and Health
AFOTEC	Air Force Operational Test and Evaluation Center
AFSOC	Air Force Special Operations Command
AFX-757	Air Force Explosive 757
AGM	Air-to-Ground Missile
AICUZ	Air Installation Compatible Use Zone Program
ANDES	Ambient Noise Directionality Estimation System
ARs	Aerial Refueling Routes
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATSDR	Agency for Toxic Substances and Disease Registry
cal	Caliber
CATEX	Categorical Exclusion
CEQ	Council on Environmental Quality
CFA	Controlled Firing Area
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CWA	Clean Water Act
CY	Calendar Year
dB	Decibels
dBP	Peak Sound Pressure Level in Decibels
DoD	Department of Defense
EA	Environmental Assessment
ECM	Electronic Countermeasures
EEZ	Exclusive Economic Zone
EF	Emission Factors
EFD	Energy Flux Density
EFDL	Energy Flux Density Level
EFH	Essential Fish Habitat
EGTTR	Eglin Gulf Test and Training Range
EIAP	Environmental Impact Analysis Process
EJ	Environmental Justice
EO	Executive Order
EPF	Environmental Planning Function
ESA	Endangered Species Act
EWTA(s)	Eglin Water Test Area(s)
FAA	Federal Aviation Administration

LIST OF ACRONYMS AND ABBREVIATIONS CONT'D

FDEP	Florida Department of Environmental Protection
FGFWFC	Florida Game and Freshwater Fish Commission (now known as FWC)
FL	Flight Level
ft	Feet
FWC	Florida Fish and Wildlife Conservation Commission (previously FGFWFC)
FY	Fiscal Year
GBU	Guided Bomb Unit
GCMFC	Gulf Coast Marine Fisheries Commission
GIS	Geographic Information System
GMP	Gulf of Mexico Program
GOM	Gulf of Mexico
GPS	Global Positioning System
HAPC	Habitat of Particular Concern
HMX	High Melting Explosive
HOB	Height of Burst
Hz	Hertz
ICAO	International Civil Aviation Organization
IFR	Instrumentation Flight Rules
IHA	Incidental Harassment Authorization
INS	Inertial Navigation System
JASSM	Joint Air-to-Surface Stand-off Missile
kHz	Kilohertz
km^2	Square Kilometers
lb(s)	Pound(s)
lb/in^2	Pounds per Square Inch
LF/MF	Low Frequency/Medium Frequency
LOA	Letter of Authorization
m	Meter
MAJCOM	Major Command
MARPOL	Marine Air Pollution
mg/L	Milligrams per Liter
mi^2	Square Mile
mm	Millimeter
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MMSN	Marine Mammal Stranding Network
MOAs	Military Operations Areas
MSDS	Material Safety Data Sheets
MSL	Mean Sea Level
Mta	Metric Tons Annually
MTR	Military Training Route
NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NEPA	National Environmental Policy Act
NEW	Net Explosive Weight
NHPA	National Historic Preservation Act
Ni-Cd	Nickel-Cadmium
NM	Nautical Miles
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NO_x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System

LIST OF ACRONYMS AND ABBREVIATIONS CONT'D

OCS	Outer Continental Shelf
OSHA	Occupational Safety and Health Act
PBX	Plastic Bonded Explosive
PBXN-109	Plastic Bonded Explosive 109
PM_{10}	Particulate Matter Less Than or Equal to 10 Microns in Diameter
ppb	Parts per Billion
psi	Pounds per Square Inch
psi-ms	Pounds per Square Inch per Millisecond
PSW	Precision Strike Weapon(s)
PTS	Permanent Threshold Shift
PVC	Polyvinylchloride
RAPCON	Radar Approach Control Facility
RDX	Research Department Explosive
ROI	Region of Influence
SDB	Small Diameter Bomb
SHPO	State Historic Preservation Office(r)
SIP	State Implementation Plan
SOP	Standard Operating Procedure
SUA	Special Use Airspace
TA	Test Area
TAFBI	Tyndall Air Force Base Instruction
TM	Tympanic-Membrane
TNT	2, 4, 6-trinitrotoluene
TTA	Tyndall Terminal Area
TTS	Temporary Threshold Shift
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDOI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	Volatile Organic Compound
VOR	Very-High Frequency Omnidirectional Range
ZOIs	Zones of Impact

1. PURPOSE AND NEED FOR ACTION

1.1 PROPOSED ACTION

Under the Proposed Action, the United States (U.S.) Air Force Air Armament Center (AAC) and U.S. Navy, in cooperation with the 46th Test Wing Precision Strike Branch (46 OG/OGMTA), would conduct a series of Precision Strike Weapons (PSW) test missions during the next five years utilizing resources within the Eglin Military Complex, including two sites in the Eglin Gulf Test and Training Range (EGTTR) (Figure 1-1). The weapons to be tested are the Joint Air-to-Surface Stand-off Missile (JASSM) AGM-158 A and B, and the Small Diameter Bomb (SDB) GBU-39/B. As many as two live and four inert JASSM missiles per year would be launched from an aircraft above the Gulf of Mexico (GOM) at a target located approximately 15 to 24 nautical miles (NM) offshore of Eglin Air Force Base (AFB). Detonation of the JASSM would occur under one of three scenarios.

- Detonation upon impact with the target (about 5 feet above the GOM surface).
- Detonation upon impact with a barge target at the surface of the GOM.
- Detonation at 120 milliseconds after contact with the surface of the GOM.

In addition to the JASSM explosive, as many as 6 live and 12 inert SDBs per year would also be dropped on the target. Detonation of the SDBs would occur under one of two scenarios.

- Detonation of one or two bombs upon impact with the target (about 5 feet above the GOM surface).
- Height of burst (HOB) test: Detonation of one or two bombs 10 to 25 feet above the GOM surface.

1.2 NEED FOR PROPOSED ACTION

There are three elements of need required to support the Precision Strike Weapons capabilities in the EGTTR.

1. Establishment of a large stand-off missile footprint, which is possible in the EGTTR.
2. Planning and Precision Strike Weapon system evaluations under differing scenarios.
3. Establishment of a multiyear investigation of the PSW Test.

Continued, future utilization of Eglin infrastructure for the PSW program would require extensive planning and analysis on a test-by-test basis, as has been done in the past. However, by establishing a five-year plan for PSW systems testing, the cumulative impacts and long term program can be more accurately assessed, and many of the regulatory and planning requirements, such as the National Environmental Policy Act (NEPA), the Air Force Environmental Impact Analysis Process (EIAP), Marine Mammal Protection Act (MMPA), and Endangered Species Act (ESA) consultations would be completed in advance, allowing the PSW program to focus on planning requirements.

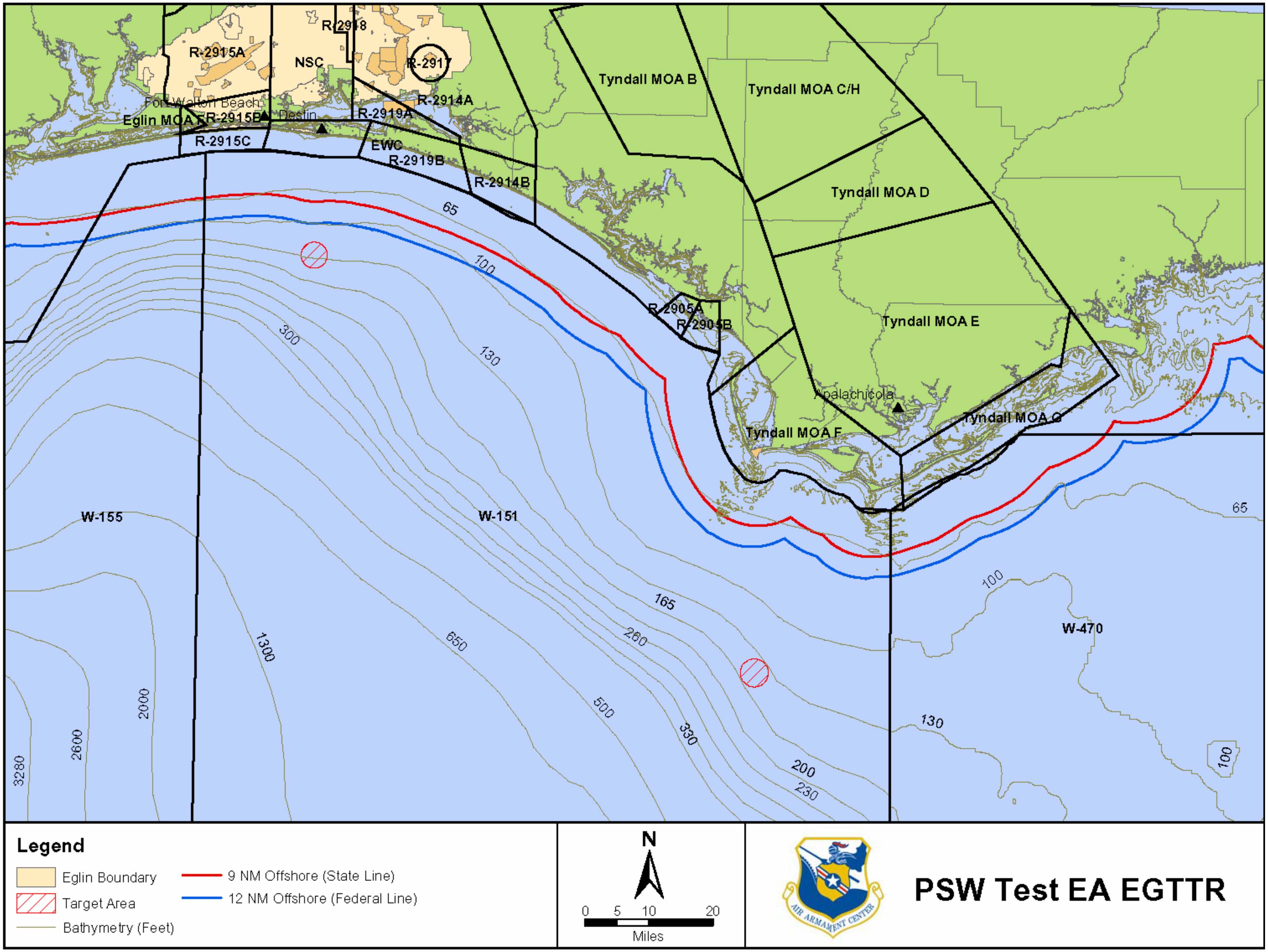

Figure 1-1. PSW Test Target Locations in the Eglin Gulf Test and Training Range (EGTTR)

1.3 OBJECTIVES OF PROPOSED ACTION

The objective of the Precision Strike Test Division is to enable the proponent to verify key/critical performance parameters, including missile integration and employment, mission planning, weapon lethality, and other system performance specifications. Furthermore, Air Force Operational Test and Evaluation Center (AFOTEC) participation in the test program would assess and determine the operational suitability and effectiveness of Precision Strike Weapons.

1.4 RELATED ENVIRONMENTAL DOCUMENTS

U.S. Air Force, 1997. *Santa Rosa Island Environmental Baseline Document*. Air Force Development Test Center, Eglin Air Force Base, Florida. October 1997.

U.S. Air Force, 1999. *Cape San Blas Final Programmatic Environmental Assessment*. AAC (Air Armament Center), 46 TW/XPE Range Environmental Planning Office, Eglin Air Force Base, Florida 31542-6808.

U.S. Air Force, 2001. *Joint Air-to-Surface Stand-off Missile (JASSM) Developmental and Evaluation Testing, White Sands Missile Range, New Mexico. Final Environmental Assessment.* December 2001.

U.S. Air Force, 2003. *Joint Air-to-Surface Stand-off Missile (JASSM) AGM-158A Programmatic Environmental Safety, and Occupational Health Evaluation.* April 2003.

U.S. Air Force, 2003. *Eglin Gulf Test and Training Range Final Programmatic Environmental Assessment, Eglin Air Force Base, Florida*. August 2003.

1.5 SCOPE OF THE ENVIRONMENTAL ASSESSMENT

This document was prepared in accordance with the requirements of NEPA, the Council on Environmental Quality (CEQ) regulations of 1978, and 32 Code of Federal Regulations (CFR) Part 989. To initiate the environmental analysis, the proponent (46 OG/OGMTA, Precision Strike Branch) submitted an Air Force (AF) Form 813, Request for Environmental Impact Analysis, to the 96th Civil Engineer Group, Environmental Management Division, Stewardship Branch, Environmental Analysis Section (96 CEG/CEVSP). A review of the AF Form 813 by CEVSP determined that the EIAP Working Group should address the Proposed Action.

1.5.1 Issues Eliminated from Detailed Analysis

Based on the scope of the Proposed and Alternative Actions and preliminary analyses, the following issues were eliminated from further analyses.

Air Quality

Air quality, with respect to those pollutants for which the U.S. Environmental Protection Agency (USEPA) has promulgated national ambient air quality standards (NAAQS) and/or the Florida Department of Environmental Protection (FDEP) has promulgated an ambient standard, was

eliminated as a potential issue. A preliminary analysis of project-generated air emissions was conducted to determine if:

- There would be a violation of NAAQS.
- Emissions would contribute to an existing or projected air quality violation.
- Sensitive receptors would be exposed to substantial pollutant concentrations.
- There would be an increase of 10 percent or more in Okaloosa County criteria pollutants emissions.
- Any significance criteria established by the Florida State Implementation Plan (SIP) would be exceeded.
- A permit to operate would be required.
- A change to Eglin's Title V permit would be required.

Under existing conditions, the ambient air quality in Okaloosa and surrounding counties is classified as attainment for all NAAQS as promulgated by USEPA. The primary emission sources associated with the Proposed Action and Alternative Action are the release and generation of emissions resulting from weapons, their release upon detonation, and emissions from surface craft and aircraft. Due to the small number of shots per year, the small size of each shot, and the short duration of each test event, emissions are not anticipated to have any impact on ambient air quality in Okaloosa and surrounding counties.

The estimated emissions are significantly less than 10 percent of Okaloosa County's emissions and therefore would not be expected to cause any potential adverse affect on ambient air quality. Any emissions effects would be temporary and would fall off rapidly with distance from the test site. Due to the short-term effect of test-related emissions and releases, fugitive combustive emissions from vehicles, and the small area affected, there would be no potential adverse cumulative impact on air quality from test-related activities conducted under either the proposed or alternative actions. Results are provided in Table 1-1.

Table 1-1. Emissions from Proposed Action (Tons)

Pollutant Emission Source	CO	NO_x	PM_{10}	VOCs
Maximum PSW Test	0.0036287	0.0476272	0.16	0.0004536
Okaloosa County total emissions (CY2000)*	91,359.90	8,709.10	3,756.50	11,957.70**
Eglin AFB total emissions (CY2000)	95.40	117.70	114.60	105.70
Percent Change Okaloosa County	0.00	0.00	0.00	0.00

* Source: Air Emissions Inventory Guidance Document for Stationary Sources at Air Force Installations 1999, Institute for Environment, Safety, and Occupational Health Risk Analysis, Risk Analysis Directorate Environmental Analysis Division, Brooks AFB, Texas. May.
** Includes mobile sources.
CY = calendar year

The release of combustibles and emissions is not expected to adversely impact air quality, as they would be released intermittently and in small quantities.

Environmental Justice

Concern that minority populations and/or low-income populations bear a disproportionate amount of adverse health and environmental effects led to the issuance of Executive Order 12898 in 1994. Executive Order (EO) 12898, Environmental Justice (EJ), and the accompanying Memorandum ensure that federal agencies focus attention on:

> *"The environmental effects, including human health, economic and social effects, of federal actions, including effects on minority communities, and low income communities, when such analysis is required by NEPA 42 USC section 4321 et seq."*

Environmental justice addresses the potential for a proposed federal action to cause disproportionately high and adverse health effects on minority populations or low-income populations. Executive Order 13045 mandates that all federal agencies assign a high priority to addressing health and safety risks to children, coordinating research priorities on children's health, and ensuring that their standards take into account special risks to children. Since the proposed activities would take place in the EGTTR and no impacts are anticipated in inhabited areas adjacent to the Gulf test areas, neither environmental justice impacts nor special risks to children will not occur.

1.5.2 Issues Studied in Detail

Preliminary analysis based on the scope of the Proposed and Alternative Actions identified the following potential environmental issues warranting detailed analysis.

Water Quality

Mission support activities, such as set-up activities or use of equipment in water areas, or the use of expendables (test items including the inert and live JASSMs and the inert and live SDBs) over water areas could affect water quality. Additionally, deployed expendables may introduce pollutants in the form of fuel to the water. Analysis focuses on assessing the location of such activities under the Proposed Action and alternatives and the potential to impact these areas. This is accomplished using geographic information systems (GISs) and current hydrologic literature and data for the surrounding areas.

Geology

The potential exists for sediments and the seafloor that provide habitat for a variety of marine organisms to be affected by PSW testing. Analysis of this issue focuses on identifying activities under the alternatives that would impact geological resources and the resulting consequences to the quality and utility of sediments.

Noise

Noise from the explosives is a potential source of injury to biological resources. Analysis of this issue evaluates the noise profiles associated with the alternatives and the potential for the 140-dBP (peak sound pressure level in decibels) noise profile (potential injury level) to reach

public users in the Gulf. The detonation noise has the potential to harass or injure marine mammals and sea turtles.

Biological Resources

Biological resources (plants and animals) and related habitats (foraging and nesting areas) may be directly affected by the alternative actions. Impacts analysis focuses on the potential for actions to directly, physically affect sensitive biological organisms (threatened and endangered species) and the potential for actions to alter/affect the quality and utility of the sensitive habitats (i.e., essential habitat and foraging areas) frequented by those species. Mission and support activities (target structures, anchoring, etc.) could affect biological resources (marine mammals, fish, marine birds, etc.) in the test areas. Construction and use of a target barge could also impact marine resources. The location and duration of mission activities in relation to sensitive and threatened and endangered species and habitat in the GOM are analyzed using current GIS coverage and existing literature to determine the potential for adverse impacts associated with the Proposed and Alternative Actions.

Restricted Access and Socioeconomics

Restricted access is defined as an increase or addition in restricted area and/or an increase or addition to the frequency of access restriction to public areas. Safety footprints associated with the Proposed and Alternative Actions may result in restricted access to the public in areas normally open for outdoor use, as well as inhibit use of other test areas, air space, and facilities by the military if safety footprints associated with testing extend beyond the test sites/areas. Analysis of this issue focuses on assessing restricted access footprints and duration of closures and subsequent potential impacts to recreational and commercial usage in restricted areas.

Air Space

The use and management of air space has the potential to be impacted by the Proposed and Alternative Actions. The analysis for this resource examines the federal and U.S. Air Force regulations that govern airspace, the management and scheduling of air space over the Eglin Gulf Test and Training Range, and the capabilities and constraints of air space associated with the PSW tests. Management actions to ensure safety during air space use are identified.

Safety and Occupational Health

Precision Strike Weapon tests associated with the Proposed and Alternative Actions could be potential safety hazards. Analysis focuses on determining safety footprints and restricted zones associated with weapon detonation and reviewing associated standard operating procedures (SOPs) used to ensure that military personnel and the public would not be exposed to safety hazards.

Cultural Resources

Mission support activities may disturb potential cultural resources in the area of the Proposed and Alternative Actions. Issue analysis involves determining the proximity of the alternative support footprints to cultural resource areas of constraint using GIS and coordination with the

Cultural Resources Branch (96 CEG/CEVH) to determine the potential for cultural resources to exist in the areas and assessing associated potential consequences.

1.6 APPLICABLE REGULATORY REQUIREMENTS AND COORDINATION

The 46 OG/OGMTA would be responsible for all permits, coordination, and management actions outlined within this document. They would coordinate with the appropriate branches of the 96 CEG listed within this section and Chapter 5 to ensure compliance with all regulatory requirements.

1.6.1 Agency Consultation

In compliance with the ESA and Marine Mammal Protection Act, the Air Force initiated consultation for an incidental take authorization from National Oceanic and Atmospheric Administration (NOAA)/National Marine Fisheries Service (NMFS) in 2004. NMFS issued an Incidental Harassment Authorization (IHA) in July 2005 (see Appendix B) allowing for the authorization of the harassment of a small number of marine mammals incidental to conducting the PSW testing, provided mitigations and monitoring are conducted. The IHA, which is valid for one year, does not allow for the injury or mortality of any marine mammals. The Air Force and NMFS are currently developing a Letter of Authorization (LOA) that will cover the five-year PSW test plan and allow for the injury and mortality of a small number of marine mammals incidental to the PSW testing.

1.6.2 Permits and Agency Reviews

The Florida State Clearinghouse will review the Proposed and Alternative Actions for consistency with state agencies and regulations. A "works in the waters of Florida" permit will not be required. The FDEP will not require any permits, as the target location and zone of impact are outside of state jurisdiction. Likewise, a National Pollutant Discharge Elimination System (NPDES) permit will not be required.

Section 106 of the National Historic Preservation Act requires that federal agencies analyze the impacts of federal activities on historic properties. Notification of project activities will be provided to the State Historic Preservation Officer (SHPO); however a formal consultation will not be required. Required cultural and historic impact reviews by other federal agencies will be determined by 96 CEG/CEVH.

The Precision Strike Weapons tests will be conducted in water less than 200 feet deep. Traditionally, testing has been performed in deeper waters to eliminate safety and public relations concerns. In 200 feet of water, if left behind, the test item and any wreckage from these shots would be available for fishermen and divers to retrieve. Although it is anticipated that all materials would be recovered, consultation with the Okaloosa County Artificial Reef Coordinator is recommended prior to the mission.

If the target is significantly damaged and it is deemed impractical and unsafe to retrieve it, it may be sunk. 46 OG/OGMTA will coordinate with the U.S. Army Corps of Engineers (USACE) and the U.S. Coast Guard Marine Safety Office in Mobile, Alabama, to determine if a permit is required for sinking a target. The USACE will review the mission description prior to this action to determine consistency with Section 10 of the Rivers and Harbors Act, as extended by

Section 4(f) of the Outer Continental Shelf Lands Act. Creation of artificial reefs, as promoted by the National Artificial Reef Plan prepared by NOAA, and pursuant to section 204 of the National Fishing Enhancement Act of 1984, can result in enhancement of the offshore environment through fisheries aggregation and public use benefits.

A Notice to Mariners (NOTMAR) would be required prior to the closure of the safety buffers around target locations.

1.7 DOCUMENT ORGANIZATION

This Environmental Assessment (EA) will follow the organization established by CEQ regulations (40 CFR, Parts 1500-1508). This document will consist of the following chapters.

1. Purpose and Need for Action
2. Description of the Proposed Action and Alternatives
3. Affected Environment
4. Environmental Consequences
5. Plan, Permit, and Management Actions
6. List of Preparers
7. References

Appendix A – Mitigations for Protected Species
Appendix B – Agency Coordination
Appendix C - Protected Species Descriptions
Appendix D – Supporting Noise Analysis Information
Appendix E – Public Review Process

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This EA will address the potential for environmental impacts resulting from the Proposed and Alternative Actions, including a No Action Alternative, as required by federal regulation. Sections 2.1 through 2.3 provide a summary of the issues and potential impacts associated with the Proposed Action, the Alternative Action, and the No Action.

2.1 PROPOSED ACTION (PREFERRED ALTERNATIVE)

The Proposed Action, which is the preferred alternative, includes the maximum deployment of JASSMs at 2 live shots (single) and 4 inert shots (single) each year for the next five years. The Proposed Action also includes SDB shots at a maximum deployment of 6 live shots a year, with 1 of the shots occurring simultaneously. A maximum of 12 inert SDB shots would take place with up to 4 occurring simultaneously (Table 2-1). Test plans may require up to 6 live SDBs and 12 inert SDBs in calendar year 2007. This would provide flexibility to conduct a variety of PSW test scenarios over the five-year test period. The purpose and need of the JASSM Program requirements can be achieved by conducting the Proposed Action.

Table 2-1. PSW Test Proposed Action

Weapon	Number of Live Shots Per Year	Number of Inert Shots Per Year
JASSM	1 single shot	4 inert shots
SDB	6 shots (4 single shot and 1 double shot)	12 shots (4 single shots and 4 double shots)

JASSM (Figure 2-1) is a tactical, stand-off air-to-surface missile with conventional munitions. The JASSM weapon system is defined as the JASSM (AGM-158A) and its components (air vehicle, avionics [guidance and control], and warhead and fuse) and container. The JASSM is a precision cruise missile designed for launch from outside area defenses to kill hard, medium-hardened, soft, and area type targets. The case and filler material weighs approximately 950 pounds and is composed primarily of sodium chloride and aluminum. Table 2-2 gives the percentage of each material that makes up the JASSM. The JASSM has a range of more than 200 NM and carries a 1,000-pound warhead.

Table 2-2. Materials Comprising the JASSM

Material	Function	Percentage
Sodium Chloride	Filler	64.00%
Aluminum	Metal	18.00%
Dioctyl Adipate (DOA)	Plasticizer	10.39%
PolyBD	Polymer	6.94%
Isophorone Diisocyanate	Crosslinker	0.66%
Triphenyl Bismuth OR Dibutylin Dilaurate	Catalyst	0.01%

When live, the JASSM warhead has approximately 255 pounds of net explosive weight (NEW). The explosive used is AFX-757, a type of plastic bonded explosive (PBX) formulation with higher blast characteristics and less sensitivity to many physical effects that could trigger unwanted explosions. AFX-757 uses less expensive ingredients and is easier to process than current commonly used explosives like tritonal and Plastic Bonded Explosive 109 (PBXN-109).

The JASSM would be launched more than 200 NM from the target location. Platforms for the launch include the B-1, B-2, B-52, F-16, F-18, and F-117. Launch from the aircraft would occur at altitudes greater than 25,000 feet. The JASSM would cruise at altitudes greater than 12,000 feet for the majority of the flight profile until it makes the terminal maneuver toward the target.

Figure 2-1. Joint Air-to-Surface Stand-off Missile (JASSM) in Flight

The SDB weapon (Figure 2-2) is a 250-pound class, air-to-surface, precision-guided munitions. Table 2-3 provides information on the materials that comprise this bomb. The SDB four-place carriage system also allows aircraft to carry multiple weapons and launch them from medium-to-high altitudes in straight and level flight. SDB allows multiple target engagements on a single pass delivery. Because of its capabilities, the SDB weapon system is an important element of the Air Force's Global Strike Task Force. SDB uses a tightly coupled Global Positioning System (GPS)/Inertial Navigation System (INS) guidance system and with the use of foldout wings and control fins, has a range of over 40 NM. When live, the SDB warhead has a NEW of approximately 40 pounds of AFX-757 and inherently minimizes collateral damage. The threshold aircraft (platform used during acquisition phase) for SDB integration is the F-15E. Objective aircraft (those platforms to be integrated as the program develops) include the F/A-22, F-35, UCAV, F-16 Block 40/50, B-1B, B-2, B-52, F-117, A-10, and MQ-9 Predator B. Deployment is scheduled for late FY06.

Table 2-3. Chemical Constituents of the SDB Weapon

Material	Weight (lb)	Material	Weight (lb)
Aluminum, powder	21.000	Plastic	0.0182
Boron, elemental	0.00300	Polyethylene plastic	0.354
Carbon	0.317	RDX	45.100
Chromium	0.00656	Silicon	0.0219
Iron	156.430	Sulfur	0.0872
Manganese	0.739	Trinitrotoluene	29.200
Phosphorus	0.0655	Wax	4.700

Figure 2-2. Small-Diameter Bomb (SDB) in Flight

Chase aircraft would include F-15, F-16, and T-38 aircraft. These aircraft would follow the test items during captive carry and free flight but would not follow either item below a predetermined altitude as directed by Flight Safety. Other assets on site may include an E-9 turboprop aircraft or MH-60/53 helicopters circling around the target location. Tanker aircraft including KC-10s and KC-135s would also be used. A second unmanned barge may also be on location to hold instrumentation. This barge would be up to 1,000 feet away from the target location.

The JASSM and SDBs would be launched from B-1, B-2, B-52, F-15, F-16, F-18, or F-117 aircraft. The JASSM would be launched from the aircraft at altitudes greater than 25,000 feet. It would cruise at altitudes greater than 12,000 feet for the majority of the flight profile until it made the terminal maneuver toward the target. The SDB would be launched from the aircraft at altitudes greater than 15,000 feet. The SDB would commence a nonpowered glide to the intended target.

Based on availability, the Proposed Action would utilize two possible targets for the PSW mission tests. The first is a CONEX target (Figure 2-3) that consists of five containers strapped, braced, and welded together to form a single structure. The dimensions of each container are approximately 8 feet by 8 feet by 40 feet. Each container would contain 200 55-gallon steel drums (filled and sealed with air). These provide the buoyancy to the target. The second possible target is a hopper barge, typical for transportation of grains, beans, or corn (Figure 2-4). The hopper barge is approximately 30 feet by 12 feet and 125 feet long. The targets would be held in place by a four-point anchoring system using cables.

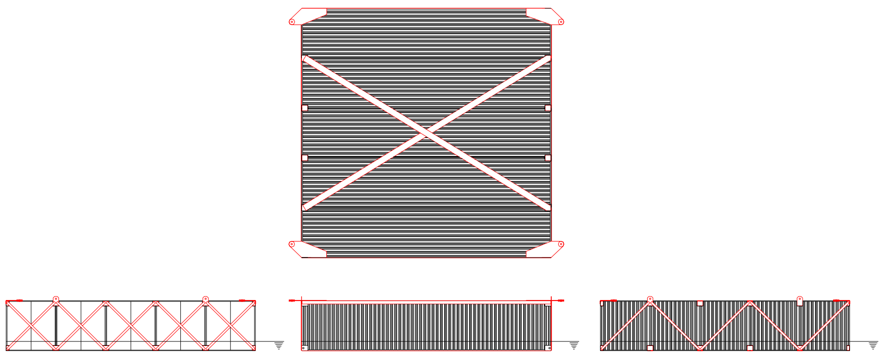

Figure 2-3. Schematic Diagram of the CONEX Target

Figure 2-4. Water Barge Target

The barge target would also be stationed at target location two to three days prior to the test. GPS measurements at the target would be made and relayed to missile launchers as part of the preparation for each test. During an inert mission, the JASSM would pass through the target and the warhead would sink to the Gulf floor. Immediately following impact, the JASSM recovery team would pick up surface debris (from the missile and target). Depending on the test schedule, the target may remain in the GOM for up to one month at a time. If the target is significantly damaged and it is deemed impractical and/or unsafe to retrieve the target, it may be sunk through coordination with the U.S. Coast Guard. Coordination with the U.S. Army Corps of Engineers and the U.S. Coast Guard Marine Safety Office in Mobile, Alabama, would be required prior to sinking a target.

The Proposed Action would occur in the northern EGTTR test areas of the GOM. Targets would be located in less than 200 feet of water and more than 12 NM offshore. Two target locations would be used: (1) south of Eglin Test Area 13-A (TA 13-A) on Santa Rosa Island (Figure 2-5) and (2) south of TA D-3 (Figure 2-6). Both are in waters less than 200 feet deep.

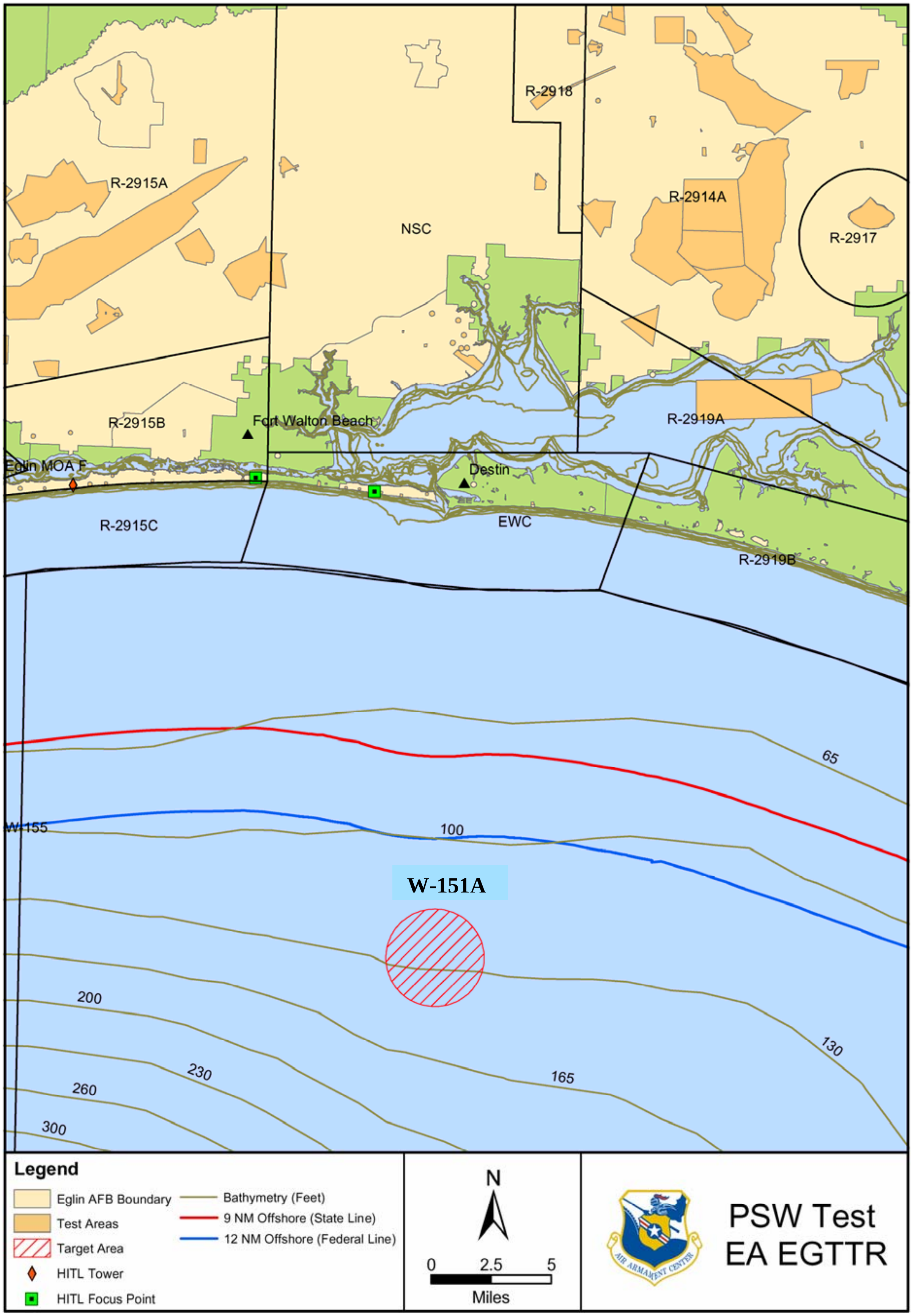

Figure 2-5. PSW Target Location Offshore of Santa Rosa Island

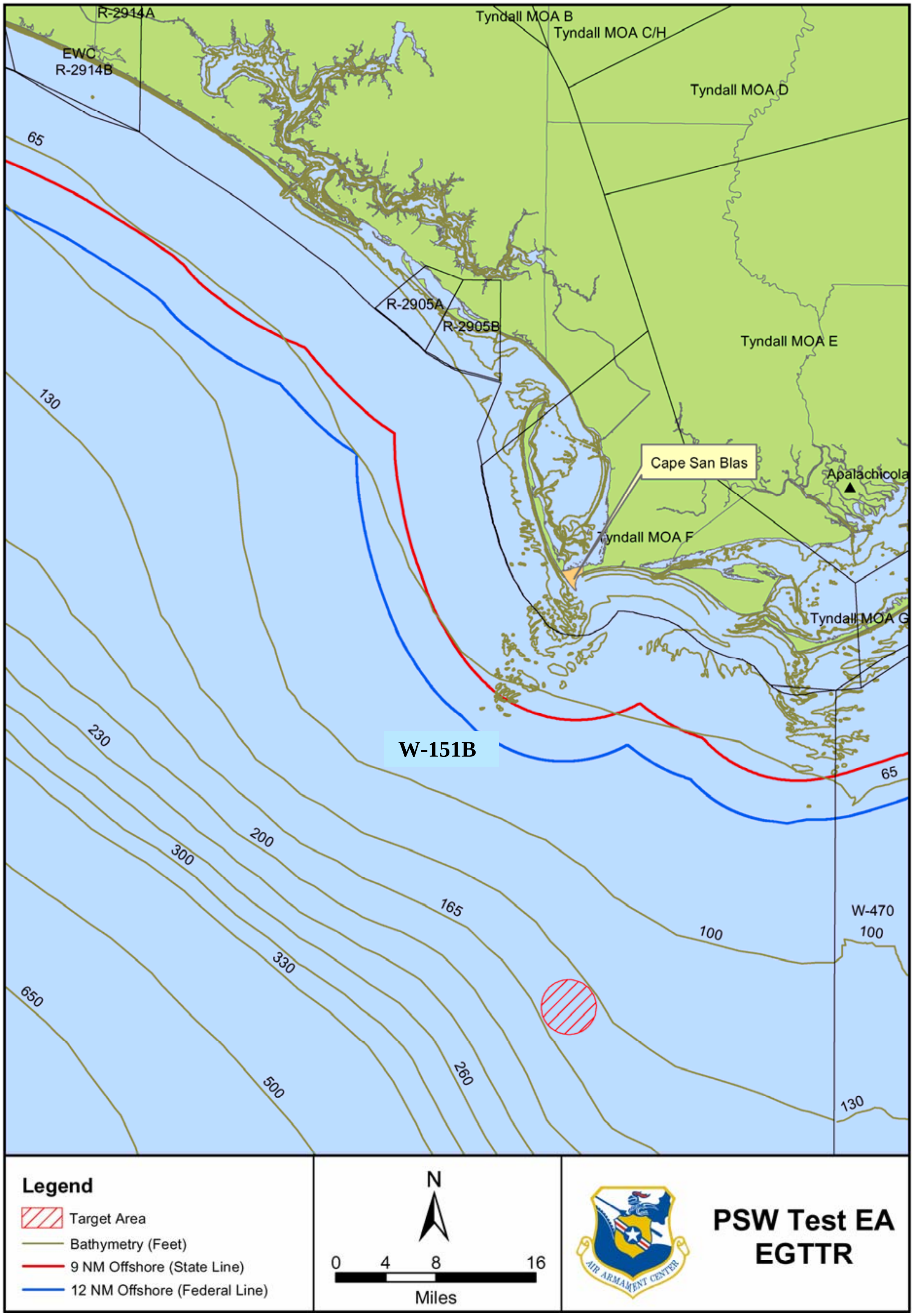

Figure 2-6. PSW Target Location Offshore of Test Area D-3, EGTTR, Florida

2.2 ALTERNATIVE 1: INCREASED INTENSITY OF LIVE JASSM SHOTS

Alternative 1 evaluates twice the number of live JASSM shots per year over the five-year plan than does the Proposed Action. Two of the live shots would be deployed from the same aircraft within 5 seconds of each other. The number of inert JASSMs deployed each year would remain the same as described for the Proposed Action. Alternative 1 also evaluates the same number of live and inert shots per year as done in the Proposed Action. Table 2-4 shows the number of shots per PSW test event under this alternative.

Table 2-4. Alternative 1 – Number of Shots per Year

Weapon	Number of Live Shots Per Year	Number of Inert Shots Per Year
JASSM	4 shots (2 single shots and 1 double shot [detonation of 2 bombs within 5 seconds])	4 inert shots
SDB	6 shots (4 single shots and 1 double shot)	12 shots (4 single shots and 4 double shots)

2.3 NO ACTION ALTERNATIVE

The No Action Alternative does not evaluate any additional PSW testing by the AAC/YV (Precision Strike Program Office) and the 46 OG/OGMTA. Limited inert tests, however, as previously categorically excluded from further analysis would continue. No SDB shots would occur. The need for weapons with the capabilities of the JASSM and SDB are critical to support national interests. Demonstration and performance verification testing is required by law. The No Action Alternative would not allow the program to meet requirements and national defense needs.

2.4 COMPARISON OF ALTERNATIVES

Table 2-5 provides a comparison of the three alternatives.

Table 2-5. Summary Matrix of Issues, Alternatives, and Potential Impacts

	Proposed Action (Preferred Alternative)	Alternative 1: Increased Intensity of JASSM Live Shots	No Action
Air Space	Overflights and aircraft in the Gulf of Mexico may be restricted during the PSW Tests. Coordination with the appropriate Eglin divisions would be required to identify proximal training areas and determine the potential impacts on and conflicts with other usage of air space.	Same as Proposed Action. With the increase in intensity of JASSM live shots under Alternative 1, an increase in air space usage and subsequent potential impacts and conflicts would exist.	No Impact
Noise	Impacts to marine life subjected to impulsive noise profiles from the PSW Test detonations. A consultation with NMFS will be performed for a Letter of Authorization Permit. Impulsive noise profiles may also reach inhabited areas, creating public disturbances.	With the increase in intensity of JASSM live shots under Alternative 1, noise profiles would increase. Subsequent impact on biological resources and public disturbances may occur.	No impact
Restricted Access and Socioeconomics	Commercial fishing vessels and all other watercraft would be restricted from the test areas off of Test Area D-3 and Santa Rosa Island during the mission. Access to recreational and commercial fishing/diving may be restricted. Shipping routes for waterborne craft may be temporarily closed. A Notice to Mariners will be issued prior to the closure.	Same as Proposed Action with additional time for restricted access during the additional shots.	No impact
Biological Resources	Exploding munitions in the Gulf may affect threatened, endangered, or sensitive plant and animal species. Anchoring targets in the Gulf may present entanglement problems for marine mammal species. Mission debris may also adversely impact biological resources. A consultation with NMFS will be performed for a Letter of Authorization Permit.	Same as Proposed Action with the potential for additional impacts due to increased intensity of live shots.	No impact
Water Quality	Test activities could affect water quality via the introduction of chemical materials from the munitions used in the Gulf. Activities could result in chemical releases to surface water.	Same as Proposed Action with the potential for additional water quality impacts due to increased intensity of live shots.	No impact
Safety and Occupational Health	Live shots over the Gulf present safety considerations. On-site mission crews may potentially be exposed to unsafe conditions (dehydration, fall hazards, etc.) associated with the maritime setting.	Same as Proposed Action with the potential for additional safety and occupational health issues presented by the increased intensity.	No impact
Cultural Resources	Detonations in the Gulf may disturb potential underwater cultural resources in the area.	Same as Proposed Action.	No impact

3. AFFECTED ENVIRONMENT

The affected environment section describes the anthropogenic environment of Eglin Air Force Base and its adjacent communities that have the potential to be impacted by the actions described in the previous chapter. The Proposed and Alternative Actions would take place in the Eglin Gulf Test and Training Range in the Gulf of Mexico, with the impact focus in Warning Areas W-151A and W-151B. Resource areas addressed are water quality, geology, noise, biological resources, restricted access/socioeconomics, air space, safety and occupational health, and cultural resources.

3.1 WATER QUALITY

Water quality in the EGTTR is impacted by chemical resources, waste disposal, tides, impacts from commercial activities, artificial reefs, and military activities.

3.1.1 Chemical Resources

Gulf waters contain many dissolved ions, principally chlorine, sodium, magnesium, calcium, potassium, bromine, boron, strontium, fluorine, carbonate, and sulfate (Petrucci, 1982). However, only six of these components make up 99 percent of the dissolved solids in the water: sodium, chlorine, magnesium, sulfur, potassium, and calcium (Millersville University, 1996). Table 3-1 identifies typical concentrations of various chemical constituents of the eastern Gulf waters.

Table 3-1. Chemical Composition of Seawater Typical of the Gulf of Mexico

Components*	Concentration (ppt)
Major	
Chloride	19.00
Sodium ion	10.50
Magnesium ion	1.35
Sulfate	0.89
Calcium	0.40
Potassium ion	0.39
Minor	
Bromide	0.065
Carbonate/Inorganic Carbon	0.028
Strontium	0.008
Borate	0.005
Silica	0.003
Fluoride	0.001
Aluminum ion	0.000005

* Other trace elements: nitrogen, iodine, phosphorus, iron, zinc, manganese, gold, organic carbon compounds
Source: Lerman, 1986

3.1.2 Tides

Compared to the Atlantic and Pacific coasts, Gulf coast tides are small and less developed, with a range usually less than 0.7 meter (ESE et al., 1987; Weber, 1992). Gulf tides may be diurnal (one high and one low daily); semi-diurnal (two highs and two low tides daily); or varying combinations of the two (Weber, 1992). Local fluctuations in tidal heights may result from strong winds, large storms, and hurricanes (Weber, 1992). The southwest Florida shelf tidal regime is mixed, composed of diurnal and semi-diurnal components (ESE et al., 1987).

3.1.3 Municipal Waste Disposal

The Marine Protection, Research and Sanctuaries Act of 1972 (commonly known as the Ocean Dumping Act), as amended by the Ocean Dumping Ban Act of 1988, gives the USEPA the power to prohibit the transport of industrial waste for ocean dumping. Municipal trash or garbage is considered industrial waste under the Act. While the USEPA does not permit the ocean dumping of trash, industrial waste, and sewage sludge, certain materials such as fish waste and dredged material can be disposed of in the ocean under the permitting process (Gulf of Mexico Program, 1993). Dumping of materials in federal waters was not regulated or recorded before 1972, so it is difficult to ascertain the amount of municipal waste dumped during that period of time (Amson, 1996). The Rivers and Harbors Act required permits issued by the Army Corps of Engineers for dumping municipal trash in state waters before the initiation of the Ocean Dumping Act.

3.1.4 Commercial Shipping

Influences on the environment from the maritime shipping industry include air quality, water quality, marine debris, introduction of non-indigenous species, and noise.

The majority of oil spills from anthropogenic sources occur from the transportation of petroleum products and crude oil by tanker and barge movements. The heaviest volumes and routes, and resulting risks of import/export crude oil spills, are through the Florida Straits, Yucatan Straits, and at major oil terminals. The total contribution of petroleum products to the entire Gulf of Mexico (not just the region of influence [ROI]) from spills in both the petroleum and maritime industries is estimated to be about 0.089 million barrels (approximately 4 million gallons) per year, or 0.012 million metric tons annually (Mta). The majority of these oil spills occur from maritime operations, 0.07 million barrels (approximately 3 million gallons) per year (MMS, 1996).

Increased enforcement through monitoring and higher fines has forced ship operators to dispose of oily ballast water and tank washings at onshore facilities in accordance with regulations (Carlton, 1996).

Annex V of the Marine Pollution (MARPOL) treaty restricts the dumping of paper, garbage, food, plastic, metal, crockery, dunnage, and rags within 12 miles of the coastline. Plastic is strictly prohibited from dumping anywhere in the marine environment, U.S. lakes, rivers, and bays. U.S. law also regulates the distance from shore and the types of garbage that may be dumped in U.S. waters (Weber, 1992). Even though MARPOL restrictions are mandatory, high amounts of operational waste debris from offshore maritime and petroleum operations washes

ashore in all Gulf States. Typical items are plastic sheeting, strapping bands, fluorescent light tubes, wooden crates, wooden pallets, glass light bulbs, hard hats, and metal drums. Plastic makes up over 60 percent of the debris that washes ashore on the nation's beaches. Passenger cruise lines are typically reported as the industry placing the highest percentage of trash into Florida's Gulf waters (Gulf of Mexico Program, 1993).

3.1.5 Artificial Reefs

The disposal of materials on the ocean floor to enhance fishing success in U.S. coastal waters has been occurring for over a century. The USACE regulates artificial reef construction in U.S. waters through its Permits and Evaluation Branch. Regulatory authority has been given to the USACE through the Rivers and Harbors Act of 1899, the Outer Continental Shelf Lands Act of 1953, the National Environmental Policy Act of 1969, the Clean Water Act of 1972, and the Marine Protection Research and Sanctuaries Act of 1972 (Ocean Dumping Act). These regulations empower the USACE to prohibit the alteration or obstruction of navigable waters of the United States and waters over the continental shelf in territorial seas without a permit from the USACE.

The USACE is required to assess the potential environmental impact of artificial reef projects before issuing a permit. The USACE is also empowered by the Clean Water Act and the Ocean Dumping Act to prohibit the discharge and transportation of dredged or fill material for the purposes of ocean dumping without first obtaining a permit. However, construction of fishing reefs is excluded from these regulations provided the nature of materials used to construct the reef is regulated by an appropriate state or federal agency.

A general permit from the USACE is given to state agencies to regulate the placement of suitable materials in state management areas for the purpose of constructing artificial fishing reefs and fish attractors (GCMFC, 1993). Parties in Florida desiring to construct artificial reef material in the state management areas must submit an application to the FDEP. Individual counties planning on deploying artificial reef material outside of state management areas must obtain a permit from both the FDEP and the USACE. Artificial reef projects planned in federal waters must obtain a separate permit from the USACE.

All materials selected for construction of artificial reefs must be inspected by the USACE or designated agency before deployment. The following excerpt from the Army Corps of Engineers general permit outlines special conditions for selection and preparation of material to be deployed (U.S. Army Corps of Engineers, 1995).

> Materials authorized by this general permit include concrete and steel culverts, Army tanks, and steel hulled or ferro cement vessels (without engines), construction-grade aluminum alloys and ferrous metals such as bridges, concrete blocks, slabs, natural limestone boulder size rocks, etc., and similar material. Materials are to be selected to avoid movement of reef materials caused by sea conditions or currents and are to be clean and free of asphalt, creosote, petroleum, other hydrocarbons, toxic residues, loose free floating material, or other deleterious substances. Such materials may be inspected by the Corps or their designee prior to placement. No automobile, truck, bus, or other vehicular tires may be used unless split and substantially embedded in concrete. Also prohibited are household appliances such as refrigerators, freezers, ranges, air conditioner units, washers, dryers and furniture, boat molds, dumpsters, polyvinylchloride

(PVC) and fiberglass materials (unless specifically designed and constructed for reef or fish attractor purposes), trailers, vehicle bodies, fuel storage tanks, etc.

Table 3-2 provides a summary of artificial reef materials currently existing under the EGTTR W-151A and W-151B.

Table 3-2. Summary of Artificial Reef Materials (tons) Under the EGTTR (W-151A/B)

EGTTR Areas		Concrete	Steel	Aluminum
W-151 A	**Total Reef Materials**	222	1,330	0
	1994/95 Amounts	0	0	0
W-151 B	**Total Reef Materials**	Insufficient Data	3,087	0
	1994/95 Amounts	0	0	0

Note: Conservative estimates were made for artificial reef sites based on limited available information. Material in artificial reef sites is underestimated and does not represent total amounts. Copper, zinc, lead, and plastic (items that are deposited during EGTTR activities) were not deposited through artificial reef programs. Total Reef Materials represents known recorded amounts to date, while 1994/95 amounts represent those reef materials deposited during that time frame.

The distance from the proposed target area off of Test Area A-13 to the nearest artificial reef is 2.8 miles. The distance from the proposed target area off of Test Area D-3 to the nearest artificial reef is over 25 miles.

3.1.6 Military Activities

Many of the Air Force and Navy activities occurring within the EGTTR involve the deposition into the marine environment of various materials, many of which are considered pollutants under the Clean Water Act (CWA). The CWA states “any addition of any pollutant to the waters of the contiguous zone or the ocean within 12 NM from any point source other than a vessel or other floating craft” requires an NPDES permit. Therefore, military activities within 12 NM of shore that contribute pollutants to EGTTR waters would require an NPDES permit under the CWA. A variety of substances are included in the definition of pollutants, including “munitions, chemical wastes, radioactive materials, and wrecked or discarded equipment” {33 USC 1362(6)}. At least one instance is known where a branch of the Department of Defense was required to obtain an NPDES permit to drop ordnance in marine waters. In 1978, an NPDES permit was issued to the Navy for ordnance testing at the Atlantic Fleet Weapons Training Facility in Puerto Rico (456 US 305, 1982). This permit was required for the Navy because the facility in Puerto Rico was used primarily for training.

Table 3-3 lists the expendables and the quantities of items used during missions from FY1995-1999 in the ROI (W-151A/B).

Table 3-3. Summary of Annual Baseline Operations in the EGTTR (FY1995-1999)

Test Area	Category	Expendable	Condition	Baseline Quantity (number of items)
W-151A	SORTIES	-	-	3,970
	BOMB	BDU-33	INERT	170
		BDU-50	INERT	74
		CBU-58	INERT	3
		CBU-87	INERT	6
		CBU-89	INERT	11
		GBU-10	INERT	2
		GBU-12	INERT	18
		GBU-22	INERT	9
		GBU-24	INERT	1
		GBU-31	INERT	3
		GBU-32	INERT	4
		JASSM (Boeing)	INERT	2
		JDAM (2,000 lbs)	INERT	7
		JSOW (AGM-154)	INERT	5
		Laser Guided Training Round	INERT	6
		MK-106	INERT	18
		MK-20	INERT	37
		MK-82 HD	INERT	3
		MK-82 LD	INERT	14
		MK-84 HD	INERT	4
		MK-84 LD	INERT	3
		SUU-25	INERT	1
	CHAFF	Bol Chaff	LIVE	640
		RR-170	LIVE	37,228
		RR-180	LIVE	135
		RR-185	LIVE	2,112
		RR-188	LIVE	7,583
		RR-ZZZ	LIVE	2,112
	DRONE	BQM-34	LIVE	2
		BQM-74E	LIVE	1
		MQM-107	LIVE	4
		QF-106	LIVE	5
		QF-4	LIVE	3
	FLARE	M-206	LIVE	15,144
		MJU-10	LIVE	3,453
		MJU-7	LIVE	13,644
		MK-25	LIVE	1,332
		MK-6 Signal	LIVE	25
		SDM Decoy	LIVE	15
		SM-206 Simulator	LIVE	671
	GUN	105 MM FU	LIVE	128
		20 MM	LIVE	0
		25 MM	LIVE	1,275
		40 MM	LIVE	536
		20 MM TR	LIVE	14,630
	MISSILE[1]	2.75 " Rocket	INERT	602
		AGM-130	INERT	4
		AGM-88	INERT	3
		AIM-120	INERT	24
		AIM-7	INERT	28
		AIM-9	INERT	31
		AIM-9	INERT	1
		STD Block II	INERT	2
		Stinger (FIM-92A)	INERT	1
		TGM-65B	INERT	1

Table 3-3. Summary of Annual Baseline Operations in the EGTTR (FY1995-1999) Cont'd

Test Area	Category	Expendable	Condition	Baseline Quantity (number of items)
W-151A Cont'd	OTHER[2]	Air Drop Sensor	INERT	5
		ALE-50 (towed radar decoy)	INERT	13
		Banner Tow (AGTS-36)	INERT	5
		Banner Tow (TDK-39)	INERT	5
		Rubber Boat	INERT	51
		Calibration Sphere	INERT	7
		Cart, Impulse, M796	LIVE	308
		Cart, Impulse, BBU-35	LIVE	109
		Fuel Tank, 300 gal	INERT	1
		Fuel Tank, 370 gal	INERT	1
		Fuel Tank, 600 gal	INERT	2
		LAU-117 Launcher	INERT	1
		LAU-118 Rack	INERT	3
		LAU-131 Launcher	INERT	3
		Marine Marker	INERT	9
		Paradrop	INERT	410
		Paratroop	INERT	350
	SMALL ARMS	.50 Cal Ball	LIVE	90,983
		5.56 mm Linked	LIVE	10,199
		7.62 mm Ball	LIVE	931,468
	SMOKE	Smoke, Green, M-18	LIVE	41
		Smoke, M-18	LIVE	10
		Smoke, Red, M-18	LIVE	32
		Smoke, Violet, M-18	LIVE	70
		Smoke, White, M-18	LIVE	27
		Smoke, Yellow, M-18	LIVE	20
W-151B	SORTIES			3,970
	BOMB	BDU-33	INERT	29
		BDU-50	INERT	15
		GBU-10	INERT	1
		GBU-12	INERT	2
		GBU-32	INERT	3
		Laser Guided Training Round	INERT	1
		MK-106	INERT	9
		MK-20	INERT	1
		MK-82 LD	INERT	2
		MK-84 LD	INERT	2
	CHAFF	RR-163	LIVE	72
		RR-170	LIVE	20,563
		RR-180	LIVE	135
		RR-188	LIVE	26,168
	DRONE	AQM-37 Navy	LIVE	2
		BQM-34	LIVE	5
		MQM-107	LIVE	5
		QF-106	LIVE	4
		QF-4	LIVE	5
	FLARE	LUU-2	LIVE	1
		M-206	LIVE	4,060
		MJU-10	LIVE	2,782
		MJU-7	LIVE	11,075
		MK-25	LIVE	159
		SM-206 Simulator	LIVE	671

Table 3-3. Summary of Annual Baseline Operations in the EGTTR (FY1995-1999) Cont'd

Test Area	Category	Expendable	Condition	Baseline Quantity (number of items)
W-151B Cont'd	GUN	105 MM FU	LIVE	46
		20 MM	LIVE	0
		25 MM	LIVE	294
		40 MM	LIVE	146
		20 MM TR	LIVE	26,023
	MISSILE	AGM-130	INERT	1
		AIM-120	INERT	37
		AIM-7	INERT	30
		AIM-9	INERT	55
		AIM-9	LIVE	1
		ASRAAM	INERT	1
		Caesar Trumpet	INERT	8
	OTHER	Air Drop Sensor	INERT	3
		ALE-50	INERT	4
		Banner Tow (AGTS-36)	INERT	8
		Banner Tow (TDK-39)	INERT	8
		Paradrop	INERT	60
		Paratroop	INERT	150
	SMALL ARMS	.50 Cal Ball	LIVE	2,584
		7.62 mm Ball	LIVE	26,606
	SMOKE	MK-58	LIVE	24
		Smoke M-18	LIVE	20
		Smoke, Signal Illum	LIVE	1

Notes: 1) Live missile motor, inert warhead
2) Other includes: Paratroops and Calibration Spheres

General: The quantities of A/S Gunnery ordnance (105 mm, 40 mm, 25 mm, 20 mm, 7.62 mm, and 0.50 cal) were adjusted to reflect the most recent (09/01/99) AFSOC aircraft loading requirements. Shaded areas = A/S gunnery.

3.2 GEOLOGY

The Gulf of Mexico, known to locals as simply the "Gulf," is a restricted oceanic basin, nearly surrounded by the United States, Mexico, and Cuba. In the southeastern portion of the Gulf, the Yucatan Straits and the Florida Straits connect the Gulf with the Caribbean and western Atlantic Ocean, respectively (Dames and Moore, 1979). The Gulf is characterized by a shallow and, in places, broad continental shelf, steep slopes leading from the shelf, two large deep-water plains, and scattered regions where the bottom is somewhat higher (Weber et al., 1992). The average depth is over three-quarters of a mile and the maximum depths in the deep waters are over two miles. The continental shelf is widest along the eastern margin, called the West Florida Shelf; along the northwestern margin, called the Texas-Louisiana Shelf; and along the southern margin, called the Campeche Shelf (Dames and Moore, 1979).

3.3 NOISE

Ambient noise in the ocean may arise from natural sources: wind action on the sea surface, rain or hail striking the sea surface, seismic activity, various types of marine life, or from human activities such as industrial operations onshore, commercial (and military) ship traffic, seismic profiling for oil exploration, and oil drilling. A widely used ambient noise model, the Ambient Noise Directionality Estimation System (ANDES), was employed to derive estimates of ambient noise for the Gulf.

Ambient noise sources may be continuous and persistent, or transient and intermittent. In open oceans, the primary persistent noise sources tend to be commercial shipping and wind action on the sea surface (Figure 3-1). Surface ships generate noise via a number of mechanisms, the most important being propeller blade cavitation. This broadband noise reaches a maximum source spectrum level in the band 40-100 Hz of 180 dB (re 1 microPascal) or more.

At any given time, there are approximately 20,000 large commercial vessels at sea worldwide. Since these sources' most significant noise component is below a few hundred hertz, and since propagation is most favorable at those frequencies (particularly in deep water), surface ships can often be heard at distances greater than 100 kilometers. Thus, at many deep-water locations, it is not unusual for the low-frequency noise field to be influenced by contributions from tens or even hundreds of surface ships.

What is commonly known as wind noise is generated by a number of mechanisms related to wind. The interaction between capillary waves driven by local wind action on the sea surface is one mechanism that has been postulated. However, the clear correlation between the onset of white caps and a rapid increase in noise level suggests that the primary mechanism is related to the breaking of waves. This breaking process causes the formation of vast numbers of bubbles that oscillate at their formation and thereby produce sound.

Although wind noise is present at all frequencies, it tends to dominate above 250 Hz. At the higher frequencies, attenuation works against wind noise propagating to great distances. Thus, unlike shipping noise (Figure 3-1), wind noise tends to be locally generated and not particularly sensitive to environmental factors that affect propagation. The one notable exception to this rule is that shallow-water wind noise tends to be several dB higher than deep-water wind noise for comparable wind speeds. There is sufficient information on transient noise sources to identify areas in which these sources may be prevalent. Upper limits for these sources may be estimated.

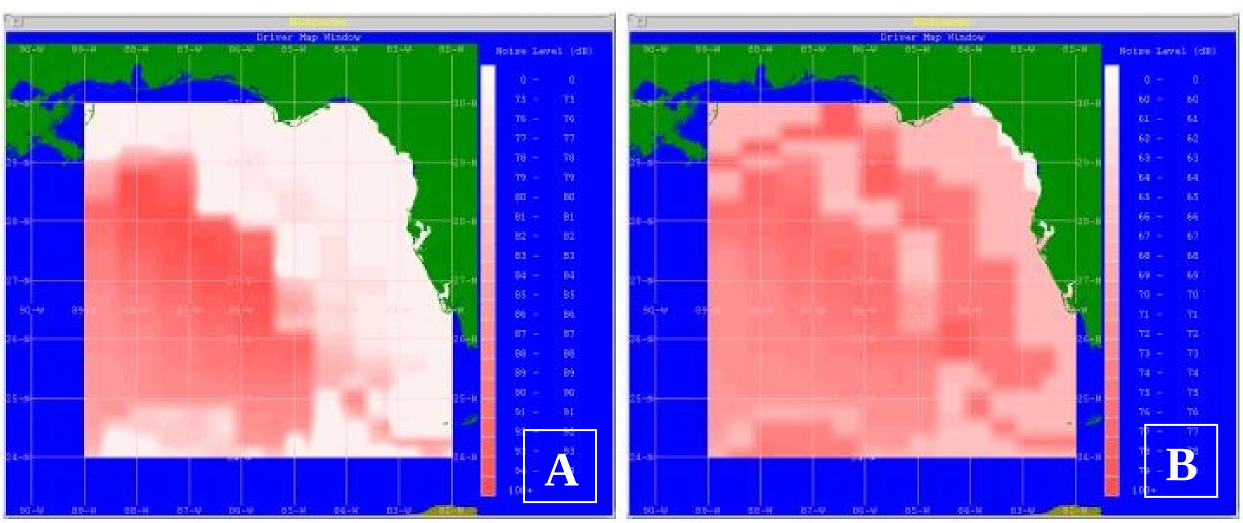

Figure 3-1. Typical Ambient Noise Levels from (A) Shipping (60-Hz) and (B) Wind (240-Hz)

3.3.1 Petroleum Industry

The petroleum industry has been actively prospecting and drilling in the Gulf of Mexico since the 1950s. Both activities are the source of considerable underwater sound. Yet despite this,

little quantitative information is available concerning the noise levels generated by these activities. It is known that seismic exploration primarily employs very low frequency sources and that these exercises can easily dominate the low-frequency noise field at some range. Oilrigs, on the other hand, produce noise throughout the frequency domain. Recently, economic and political factors have not been favorable to offshore oil exploration and production. Nonetheless, oil production continues in the Gulf, particularly along the shelf off the coast of Louisiana and eastern Texas. This activity can most likely be detected acoustically in those areas.

3.3.2 Marine Animals

Many species of marine life are known to contribute to the underwater noise field over a very wide frequency envelope. These vocalizations range from low frequency grunts and moans to very high frequency chirps, whines, and clicks. The sound producing marine species tend to belong to one of three major classes: crustaceans (shellfish), marine mammals, and certain species of true fish. Each class includes several species that have been acoustically detected and investigated. The following subsections address the most prevalent among these.

Crustaceans

Among the crustaceans, the most prevalent noisemakers are various types of snapping shrimp. Snapping shrimp are generally found in the more temperate latitudes, including the Gulf of Mexico. In these warmer waters, the occurrence of snapping shrimp is typically limited to water depths of less than 60 meters and will be most abundant in regions where the bottom sediments consist of rough boulders, cobbles, or coral rubble, or in regions where the bottom consists of shale or other loose rock structures. Conversely, sand and mud bottoms are not favorable habitats for snapping shrimp. In particular, the shelf off the western coast of Florida has numerous regions of coral that are favorable habitats for snapping shrimp.

Noise generated by snapping shrimp peaks in the frequency band of 3-10 kHz. Examples of measured noise levels indicate that the received noise level can be significant in this frequency band, easily exceeding wind noise by as much as 20 dB. However, due to propagation attenuation at high frequencies, the contribution of a bed of snapping shrimp to the total noise field strongly depends upon their proximity to the receiver.

Other crustaceans, such as other species of shrimp, crabs, sea urchins and barnacles, are also known to contribute to the noise field, particularly in warm waters. Most, if not all, produce noise in the same high-frequency band as the snapping shrimp; some produce sounds similar to that of snapping shrimp. However, there is very little known about the actual levels they produce.

Mammals

Many species of marine mammals are known to be significant sources of various types of underwater sounds. In the Gulf, clicks from sperm whales and various dolphins are measured in the 5-150 kHz range. The sounds generated by these mammals tend to be quite loud; at low frequencies, the source levels are equivalent to those of the biggest commercial ships. When

present, these mammals also tend to be acoustically active, repeating their vocalization patterns at a rapid rate.

Fish

Many types of fish have been observed to make noise; among these one of the most common is the croaker or drumfish. Croaker-like noise has been observed in numerous shallow water locations and is often referred to as a chorus because of the number of individual fish that are simultaneously vocalizing. Peak levels (around 1 kHz) that are more than 30 dB above the background level are not unusual.

Noise from another type of fish (species unknown) "chorus" was observed in the evening, often lasting for several hours following sunset. The most significant contribution from this chorus was measured in the band from 400-4000 Hz with a peak usually around 2 kHz. Again, peak levels were often 30 dB above the background levels at the peak frequency. It is not clear whether either of these examples is pertinent to the Gulf of Mexico. At best, it suggests that fish can produce noise at significant levels in the mid to high frequencies, particularly in shallow water.

3.3.3 Rain

Rain produces noise in much the same manner as does wind. Countless water droplets striking the sea surface produce impulsive sound; however, it is the fluctuation of the bubble formed by the droplets rupturing the sea surface and encapsulating a volume of air that apparently is the dominant source of sound. Rain noise differs from wind noise in that its peak contribution to the field occurs at a slightly higher frequency, typically between 1-3 kHz. Even at moderate rain rates, the noise generated at these frequencies can easily exceed contributions from wind. While the rain noise mechanism has been well studied, actual measurements of rain noise differ by 10 dB or more for similar rain rates (Figure 3-2).

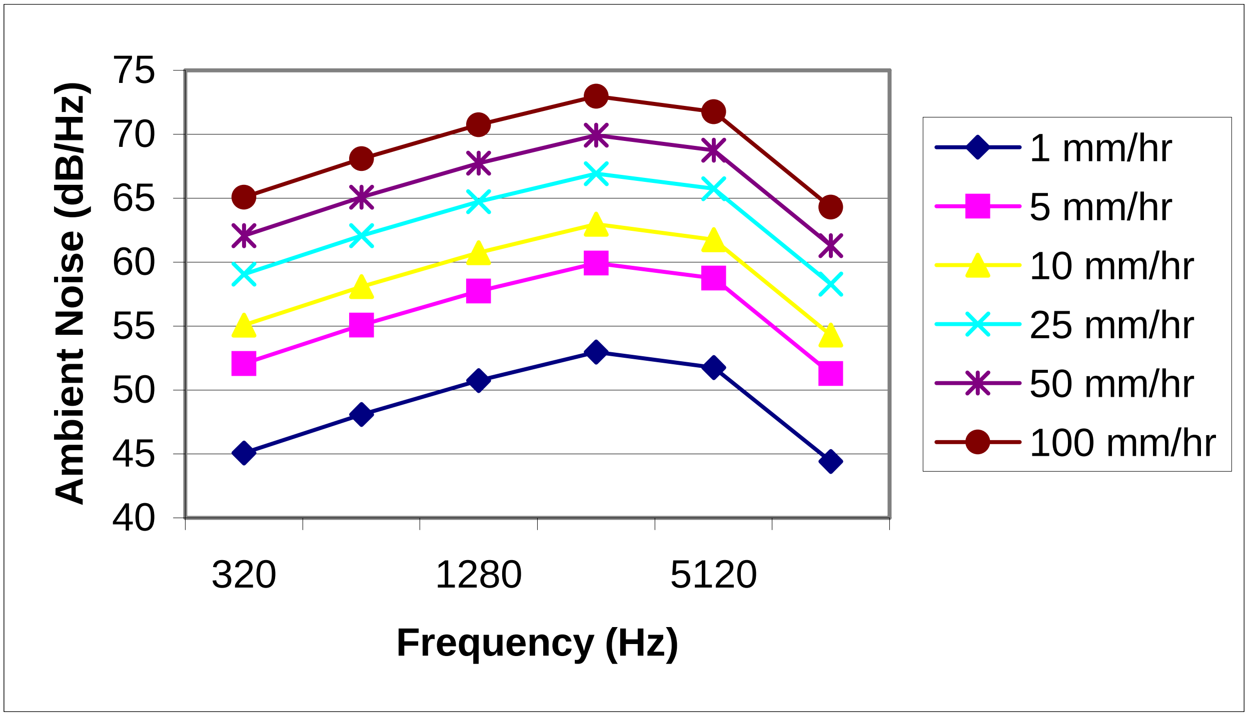

Figure 3-2. Ambient Noise Variation with Rain Rate (ANDES Noise Model, Renner, 1995)

3.3.4 Bounds on Ambient Noise

The lower bound on average noise level is defined at the low frequencies by shipping noise in regions outside the shipping lanes. At high frequencies, the lower bound is defined by wind noise at low wind speeds. From this lower bound, average noise levels increase as either the shipping density or the wind speed increases with the upper bound defined by areas of high shipping and under high wind conditions.

Intermittently, noise levels can significantly exceed the upper bound of average noise levels due to various factors. The passage of a surface ship very close to the receiver can raise low-frequency noise levels by 10 dB or more. The onset of rain raises high-frequency noise levels by 10 dB or more. Finally, marine life of various types can raise noise levels near 20 Hz (due to marine mammals), in the range of a few kilohertz (kHz) (due to crustaceans and fish), and in the tens to hundreds of kilohertz (again due to marine mammals). While the occurrence of biologic noise is limited in time and location, when it is present it can produce noise levels that are as much as 30 dB greater than background levels. The spectra presented in Figure 3-3 illustrate the variability due to all of these potential noise sources.

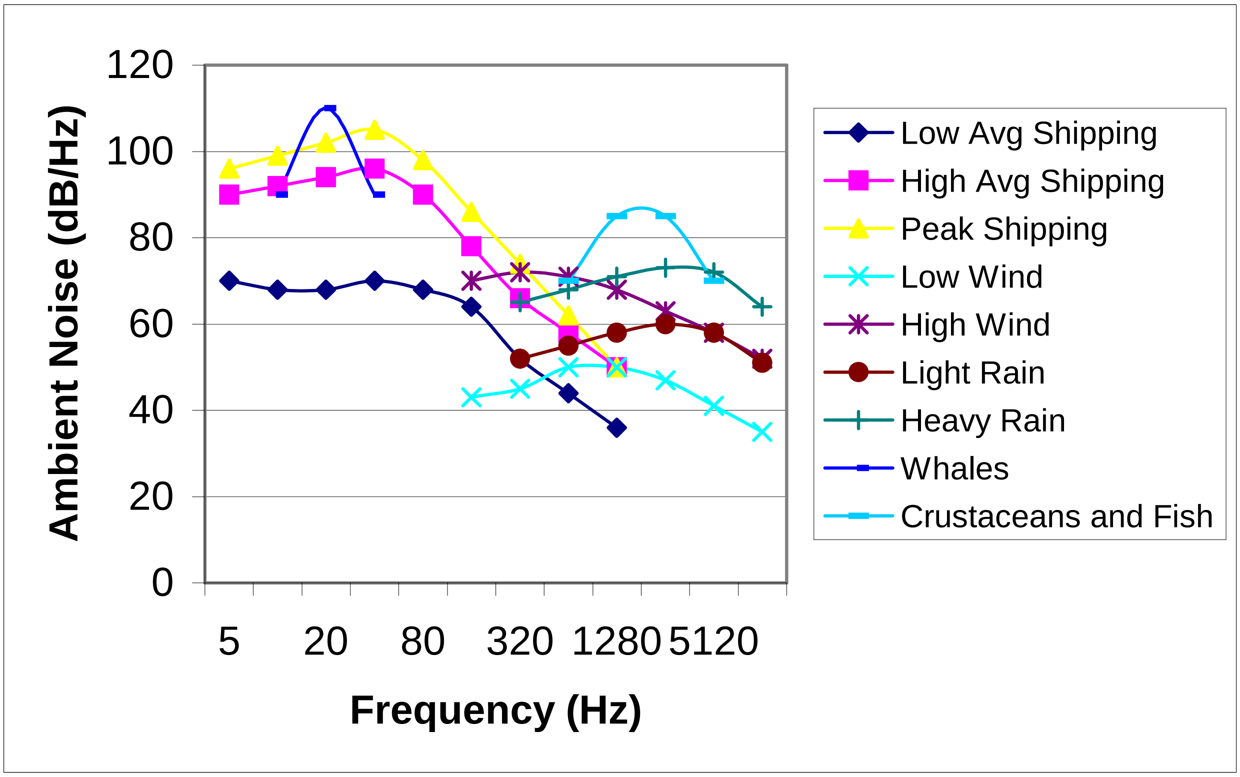

Figure 3-3. Ambient Noise Level Bounds in the Eglin Gulf Test and Training Range
(ANDES Noise Model, Renner, 1995)

3.4 BIOLOGICAL RESOURCES

This section gives a summary of the plankton community: invertebrates, fishes, marine and neotropical birds, marine mammals, threatened, endangered, and special status species, and special biological resources of the marine waters of the eastern Gulf.

3.4.1 Plankton Community

Plankton are free-floating microscopic organisms that include plant and animal species. The three general groups comprising plankton are bacterioplankton, phytoplankton, and zooplankton. Plankton is essential to the Gulf food chain, ultimately affecting fish and marine mammals.

3.4.2 Invertebrates

Oceanic invertebrate fauna include benthic fauna associated with the sediments and free-swimming pelagic animals. Benthic invertebrates include the infauna, which are animals living in the substrate (such as burrowing worms and mollusks), and the epifauna, which are animals that live on the substrate (such as mollusks, crustaceans, hydroids, sponges, and echinoderms). Benthic invertebrates are usually described in terms of species composition, density, and faunal associations. At least 1,497 species of epibiota, (plants and animals living on the substrate) including mollusks (20 percent), crustaceans (19 percent), fishes (15 percent), algae (11 percent), cnidarians (10 percent), echinoderms (8 percent), sponges (6 percent), and others (11 percent) have been collected from live bottom stations on the Florida shelf just below

W-168. Over 90 species of sponges and 53 species of scleractinian coral have been identified (Phillips et al, 1990).

3.4.3 Fishes

The eastern Gulf provides a wide variety of resources for fishes to inhabit and utilize. These resources are dependent upon their physical and chemical environment, including variables such as salinity, temperature, depth, bottom type, primary productivity, oxygen content, turbidity, and currents. Table 3-4 illustrates the more common fishes of the eastern Gulf.

Table 3-4. Common Fishes of the Eastern Gulf of Mexico

Temperate	Scientific Family Name	Common Name
	Acipenseridae	Sturgeons
	Atherinidae	Silversides
	Clupeidae	Herring, menhaden
	Cyprinodontidae	Mummichogs, killifishes
	Engraulidae	Anchovies
	Exocoetidae	Flying fishes
	Percichthyidae	Striped bass
	Pomatomidae	Bluefish
Subtropical	**Scientific Name**	**Common Name**
	Albulidae	Bonefish
	Carangidae	Jacks
	Ephippidae	Spadefish
	Holocentridae	Squirrelfishes
	Istiophoridae	Marlins
	Labridae	Wrasses
	Lutjanidae	Snappers
	Mullidae	Goatfish
	Scaridae	Parrotfish
	Sciaenidae	Drums
	Scombridae	Mackerel, bonito, tunas
	Serranidae	Groupers
	Sparidae	Porgies
	Xiphiidae	Swordfish
Tropical	**Scientific Name**	**Common Name**
	Centropomidae	Snooks
	Chaetodontidae	Butterflyfish, angelfish
	Coryphaenidae	Dolphinfish
	Elopidae	Tarpon
	Gerreidae	Mojarras
	Lutjanidae	Snappers
	Pomacentridae	Damselfish
	Pomadasyidae	Grunts
	Rachycentridae	Cobia
	Sciaenidae	Drums
	Sphymidae	Hammerhead sharks
	Sphyraenidae	Barracudas

Fishes of the eastern Gulf can be characterized by where they live in the water column. Benthic and reef fishes live at the bottom of waters and around artificial or natural reef systems. Pelagic

fishes, which spend most of their lives in the open waters of the Gulf, make seasonal, latitudinal migrations along the west coast of Florida. These migrations are caused by seasonal changes in temperature, movement of their food resources, and spawning instincts. King and Spanish mackerel leave their wintering areas in south Florida and move northward in the spring along the continental shelf. Both species spawn over the continental shelf from northwestern Florida to the northwestern Gulf off Texas. The shallow portion of the shelf at the high nutrient areas near river plumes is likely used for nursery areas (MMS, 1990).

High concentrations of profitable fish are typically found along the eastern Gulf, at the east Mississippi Delta, the Florida Big Bend Seagrass Beds, the Florida Middle Ground, the mid-outer shelf, and DeSoto Canyon. These fish are targeted by fishermen, and many of the commercially important fish species in the Gulf are believed to be in decline due to overfishing.

3.4.4 Migratory and Nonmigratory Birds

The eastern Gulf is a migratory route for numerous bird species. Approximately two-thirds of the breeding bird species of the eastern United States migrate to Central and South America, Mexico, and the Caribbean (Keast and Morton, 1980). Some important resting areas for migratory birds include St. Andrew State Recreation Area, Gulf Islands National Seashore, St. Joseph Peninsula State Park, and St. George Island State Park (Duncan, 1994). Some of the migrant species of this region are summarized in Table 3-5 (Fisher, 1979; Fritts and Reynolds, 1981; Duncan, 1991). All migratory birds are protected under the Migratory Bird Treaty Act, originally passed in 1918 (USFWS, 1996).

Table 3-5. Migratory Birds Found in the Eastern Gulf of Mexico

Wading and Shore Birds	Land Birds and Birds of Prey	Waterfowl	Pelagic Birds
Upland sandpiper	Peregrine falcon	Blue-winged teal	Shearwaters
White-rumped sandpiper	Ruby-throated hummingbird		Storm petrels Boobies Tropic birds
Semipalmated sandpiper	Blackpoll warbler Chimney swift		Phalaropes Bridled terns Black terns
Eastern kingbird	Mourning doves		
Cattle egret			

Many nonmigratory (resident) birds are found in or near the eastern Gulf all year. They do not migrate to other geographical areas as the seasons change. The brown pelican, a bird familiar to everyone in the eastern Gulf, has been removed from the federal endangered species list in Florida, but remains a species of special concern (MMS, 1990; Florida Game and Freshwater Fish Commission, 1994). The double-crested cormorant (*Phalacrocorax auritus*), common throughout North America, is a marine bird that usually stays and breeds near the coast (Fritts and Reynolds, 1981; Udvardy, 1985). Laughing gulls (*Larus atricilla*) and royal terns (*Sterna maxima*) have been sighted in both the winter and summer seasons (Fritts and Reynolds, 1981). The frigatebirds (*Fregata magnificens*) may be observed along the coast and seldom go far from land. They can be seen at any time of the year and have been spotted over waters between 25 and 50 meters deep (Fritts and Reynolds, 1981; Duncan, 1991; Udvardy, 1985).

3.4.5 Marine Mammals

Marine mammal species that potentially occur within the EGTTR include several species of cetaceans and one sirenian, the West Indian manatee. During winter months, manatee distribution in the Gulf of Mexico is generally confined to southern Florida. During summer months, a few may migrate north as far as Louisiana. However, manatees primarily inhabit coastal and inshore waters, and rarely venture offshore. Therefore, effects on manatees are considered very unlikely, and the discussion of marine mammal species is confined to cetaceans.

Cetacean abundance estimates for the study area are derived from GulfCet II (Davis et al., 2000) aerial surveys of the continental shelf within the Minerals Management Service Eastern Planning Area, an area of 70,470 square kilometers (km^2). Texas A&M University and the National Marine Fisheries Service conducted the surveys from 1996 to 1998. Abundance and density data from the aerial survey portion of the survey best reflect the occurrence of cetaceans within the EGTTR, given that the survey area overlaps approximately one-third of the EGTTR and nearly the entire continental shelf region of the EGTTR where military activity is highest.

Cetaceans inhabiting the study area may be grouped as odontocetes (toothed whales, including dolphins) or mysticetes (baleen whales). Most of the cetaceans occurring in the Gulf are odontocetes. Very few baleen whales exist in the Gulf and most would not be expected to occur within the study area given the known distribution of these species. Cetaceans considered to be common in the Gulf of Mexico include the Atlantic bottlenose dolphin (*Tursiops truncatus*), pantropical spotted dolphin (*Stenella attenuata*), Atlantic spotted dolphin (*Stenella frontalis*), and striped dolphin (*Stenella coeruleoalba*). Of all large whale species in the Gulf, sperm whales (*Physeter macrocephalus*) are most abundant (Mullin, 1996). Table 3-6 lists the cetacean species identified in GulfCet II aerial surveys and provides surface density and abundance estimates for each species. In order to provide better species conservation and protection, the species density estimate data were adjusted by incorporating 1) temporal and spatial variations, 2) surfaced and submerged variations, and 3) overall density estimate confidence.

The GulfCet II aerial surveys identified different density estimates of marine mammals for the shelf and slope geographic locations. Accordingly, the greatest species density estimate available for any given location was utilized for conservative impact assessments. The final adjusted density incorporates marine mammal submergence factors and a confidence level of the density estimates. The GulfCet II surveys focus on enumerating animals detected at the ocean surface and therefore do not account for submerged animals. The percent time that an animal is submerged versus at the surface was obtained from Moore and Clarke (1998), and the density estimates were adjusted accordingly. Additionally, the standard deviations of the densities were calculated, and the information was used to provide an approximately 99 percent confidence level for the adjusted densities. Table 3-6 shows the GulfCet II data and the final adjusted densities. A brief description of each marine mammal species observed during GulfCet II aerial surveys is provided in Appendix C.

Table 3-6. Cetacean Statistics from Surveys of the Continental Slope (1996-98)

Species	n	S	D	N	Dive Profile - % at Surface	Adjusted Density/ km^2
Bryde's whale	2	4.0	.035	25	20	0.007
Sperm whale	8	1.5	.052	37	10	0.011
Dwarf/pygmy sperm whale	19	1.8	.267	188	20	0.024
Cuvier's beaked whale	2	2.0	.031	22	10	0.010
Mesoplodon spp.	5	2.2	.084	59	10	0.019
Pygmy killer whale	3	15	.309	218	30	0.030
False killer whale	1	31	.213	150	30	0.026
Short-finned pilot whale	1	33	.227	160	30	0.027
Rough-toothed dolphin	1	34	.234	165	30	0.028
Bottlenose dolphin	83	9.9	14.798	3,959	30	0.810
Risso's dolphin	31	8.8	1.87	1,317	30	0.113
Atlantic spotted dolphin	15	24.8	8.89	1,800	30	0.677
Pantropical spotted dolphin	43	67.4	19.369	13,649	30	1.077
Striped dolphin	7	66.7	3.119	2,198	30	0.237
Spinner dolphin	72	63.1	12.302	8,670	30	0.915
Clymene dolphin	5	97.4	3.253	2,292	30	0.253
Unidentified dolphin*	5	8.2	0.665	199	30	0.053
Unidentified small whale	1	3.0	0.023	16	10	0.008
Totals			**65.74**			**4.325**

Source: Davis et al., 2000; Moore and Clarke, 1998
n = number of groups, S = mean group size, D = animals/100 km^2, N = abundance estimate
*Bottlenose dolphin/Atlantic spotted dolphin

Threats to Marine Mammals

Cetaceans are potentially subject to harm from a variety of sources, including certain military activities, oil and gas exploration, dredging, commercial shipping, and commercial and recreational fishing. Noise and other disturbances from these activities can cause the animals to abandon areas, change migratory routes, or leave a feeding ground. Detonations related to oil platform removal have been shown to harm cetaceans within the area. Cetaceans are susceptible to auditory damage from explosive shock waves and from other negative effects of noise. Background noise from drilling platforms and ship traffic can affect cetaceans by masking intra-specific communication or interfering with acoustic detection of prey or predator (Tucker and Associates, 1990; Burrage, 1992; Weber et al., 1992).

Marine Mammal Strandings

The stranding of marine mammals occurs for numerous reasons with the vast majority of the causes leading up to individual incidents remaining unknown. Some of the natural causes of strandings include illness, parasites, infant mortality, predation, and red tide. The identified anthropogenic causes of mortality and stranding include net fishing by-catch, intentional wounding, toxins, and noise. Information on the stranding of marine mammals within the Gulf of Mexico has been collected by both U.S. government agencies and private organizations for over 20 years. The most active organization in this effort is the Marine Mammal Stranding Network (MMSN), which is established, coordinated and authorized by NMFS and is comprised

primarily of volunteers in several states who aid in research and provide assistance to the rescue and reporting of stranded animals.

A review of stranding data from 1990 to 1999 indicated that 30 percent of strandings occurred near Galveston Bay while 8 percent of the strandings occurred along the Florida Panhandle. A further investigation shows that during this period one stranding per 1.7 miles of coastline occurred within the Florida Panhandle. The Gulf-wide average was one stranding per 2.0 miles. Cause and effect relationships for stranding events are not apparent from the information present in the stranding database. Seasonal fluctuations are observed, with winter and spring having a higher number of strandings than summer and fall. The reasons for this trend could vary from natural, anthropogenic, a function of changes in data gathering efforts, or a combination of these factors.

3.4.6 Threatened, Endangered, and Special Status Species

This section will discuss the threatened, endangered, and special status species. The Gulf of Mexico is an ecosystem that provides critical habitat for many threatened, endangered, and special status species. There are 15 federally listed species under the ESA that are known to live in the open ocean waters of the eastern Gulf within the ROI. Five species of sea turtles (green, loggerhead, Kemp's ridley, hawksbill, and leatherback), and seven marine mammal species (right, sei, fin, humpback, sperm, and blue whales and the West Indian manatee) are included in that number. The Gulf of Mexico sturgeon is discussed though it is not known how far out in the Gulf they travel.

An endangered species is one that is in danger of extinction in a significant portion of its range or throughout all of its range. A threatened species is a species that is likely to become endangered in the future resulting from human impacts and degradation of habitat. A list of endangered or threatened species is published in the Federal Register by the U.S. Fish and Wildlife Service (USFWS) for potential listing as Endangered or Threatened. A species may either be a candidate, proposed, or listed. Species protected under the Florida Endangered Species Act of 1990 also receive consideration at Air Force bases when activities are being proposed and planned (U.S. Air Force, 1996a). The state of Florida lists the pillar coral (*Dendrogyra cylindrus*) as endangered (it does not occur within the ROI) and the brown pelican (*Pelecanus occidentalis*) as a species of special concern.

The ESA of 1973, as amended (16 USC §§ 1531-1544), provides a means whereby the habitats of endangered and threatened species may be conserved. The Act also sets a regulatory framework for the conservation of those species. Implementing regulations are found in Volume 50 of the Code of Federal Regulations. Under the ESA, it is prohibited to take any listed species. This includes harassment, harm, pursuit, hunting, shooting, wounding, killing, trapping, capture, collection, or any attempts at these activities. All cetaceans are protected by the Marine Mammal Protection Act (MMPA, 1972, amended 1988) administered by NOAA/NMFS and USFWS. Offshore species are under the jurisdiction of the NMFS and coastal species are monitored by the USFWS (Patrick, 1996). A summary of federal and state listed species is presented in Table 3-7.

Table 3-7. Summary of Listed and Candidate Species Known to Occur within the ROI

Species	Status[*]	Areas of Occurrence
FISH		
Gulf sturgeon *Acipenser oxyrhynchus desotoi*	FT, SSC	Lives predominately in the northeastern Gulf of Mexico; may venture out to 20 miles. Moves inland to spawn. Within the ROI, spawning takes place in the Choctawhatchee River to the east of Eglin AFB and the Apalachicola River to the east of Tyndall AFB during April through June.
Dusky shark *Carcharinus obscurus*	C	One of the larger shark species of continental shelf waters; occurs in Atlantic and Pacific. Feeds on fish, other sharks, rays, squid, octopus, and starfish.
Sand tiger shark *Odontaspis taurus*	C	In North America, the sand tiger ranges from the Gulf of Maine to Florida and the Gulf of Mexico.
Night shark *Carcharinus signatus*	C	Occurs in deep waters from Delaware to Brazil including the Gulf of Mexico. It feeds on fishes and shrimp and has no economic significance.
Speckled hind *Epinephelus drummondhayi*	C	Occurs from North Carolina and Bermuda to Florida. Reddish brown in coloration with light speckles.
Jewfish *Epinephelus itajara*	C	Occurs from Florida and northern Gulf through Caribbean to southeastern Brazil, west Africa, and parts of eastern Pacific. May grow to 700 pounds. Possession by anglers is illegal.
Warsaw grouper *Epinephelus nigritus*	C	Common from Massachusetts to Texas. Smaller individuals occur around jetties and offshore platforms; adults prefer deeper, cooler waters.
Nassau grouper *Epinephelus striatus*	C	Occurs from Bermuda to North Carolina; rare and uncertain occurrence in Gulf.
Alabama shad *Alosa alabamae*	C	Occurrence is unknown east of Choctawhatchee Bay in the Florida panhandle.
REPTILES		
Atlantic green sea turtle *Chelonia mydas*	FE, SE	Inhabits open water and hard bottoms of marine environment. Nests within the ROI from May to August.
Hawksbill sea turtle *Eretmochelys imbricata*	FE, SE	Inhabits open water. Does not nest within ROI.
Kemp's Ridley sea turtle *Lepidochelys kempi*	FE, SE	Smallest and most endangered of the sea turtles. Inhabits open water. Does not nest within ROI, but does occur in ROI waters.
Leatherback sea turtle *Dermochelys coriacea*	FE, SE	Inhabits open water and hard bottoms of marine environment. Does not nest within ROI, but does occur within ROI waters.
Atlantic loggerhead sea turtle *Dermochelys coriacea*	FT, ST	Inhabits open water and hard bottoms of marine environment. Hatchlings are often associated with *Sargassum* rafts. Nests within the ROI from April to October.
CORAL		
Pillar coral *Dendrogyra cylindrus*	ST	
BIRDS		
Brown pelican *Pelecanus occidentalis*	SSC	
MAMMALS		
Manatee *Trichechus manatus*	FE, SE	Herbivorous aquatic mammals. Diet consists mainly of water hyacinth, hydrilla, turtle grass, manatee grass, and shoal grass. Usually occurs south of Suwannee River, but has been sighted in northwest Florida.
Sperm whale *Physeter macrocephalus*	FE, SE	The most abundant of the federally listed endangered whales in the Gulf of Mexico. Areas of relatively high abundance west of W-155B and W-151.
Blue whale *Balaenoptera musculus*	FE	Largest animal on earth. Rare visitor in U.S. Atlantic. Not expected to occur within the ROI.
Fin whale *Balaenoptera physalus*	FE, SE	Common in North Atlantic, but not expected to occur within the ROI.
Humpback whale *Megaptera novaeangliae*	FE, SE	Common in North Atlantic, but not expected to occur within the ROI.
Northern Right whale *Eubalaena glacialis*	FE	Most endangered of the large whales. Population probably declining. Occurs off Atlantic coast, but not expected to occur within the ROI.
Sei whale *Balaenoptera borealis*	FE, SE	Occurs off Atlantic coast, but not expected to occur within the ROI.

[*] FE = Federal endangered, FT = Federal threatened, C = Federal candidate, SE = State endangered, ST = State threatened SSC = State species of special concern,

Gulf Sturgeon

The USFWS and NMFS designated the Gulf sturgeon (*Acipenser oxyrhynchus desotoi)* as threatened under the ESA; listing became official on 30 September 1991. A special rule is in place to allow the taking of Gulf sturgeon for educational and scientific purposes, propagation or survival of the fish, zoological exhibition, and other conservation purposes consistent with the ESA (USFWS and Gulf States Marine Fisheries Commission, 1995).

The Gulf sturgeon migrates from salt water into large coastal rivers to spawn and spend the warm months (Wordsworth Dictionary of Science and Technology, 1995). It lives predominately in the northeastern Gulf of Mexico, where it ranges from the Mississippi Delta east to the Suwannee River in Florida. The species is almost depleted throughout most of its range (U.S. Coast Guard, 1996). Spawning takes place in freshwater, such as the Choctawhatchee River to the west of Tyndall AFB and the Apalachicola River to the east of Tyndall AFB, during April through June (Paruka, 1996). No freshwater spawning areas exist for sturgeon around the Tyndall AFB area (Paruka, 1996). Little is known about the offshore distance the Gulf sturgeon travels, but analyses of stomach contents suggest that feeding occurs as far as 20 miles offshore (Page and Burr, 1991; U.S. Coast Guard, 1996). The biggest threats to Gulf sturgeon populations are oil exploration activities, shrimp trawls, dams, and waste disposal (Wooley and Crateau, 1985; MMS, 1990; Paruka, 1996).

Sea Turtles

Five species of sea turtles inhabit the waters in or near the eastern Gulf. Of the five species protected by state and federal governments, all but the loggerhead are classified as endangered. The loggerhead is classified as threatened by both the Florida and the federal governments (Patrick, 1996). The smallest species is the Kemp's ridley (75 to 100 pounds) and the largest is the leatherback (up to 2,000 pounds and eight feet long). Sea turtles spend their lives at sea and only come ashore to nest. It is theorized that young turtles, between the time they enter the sea as hatchlings and their appearance as subadults, spend their time drifting in ocean currents among seaweed and marine debris (Carr, 1986a, 1986b, 1987). The population numbers of sea turtles was gravely reduced during the twentieth century due to illegal domestic harvesting of eggs and turtles in the United States and its territories as well as other important nesting areas around the world. Sea turtles are identified in Table 3-8 according to their status of federal protection in the Gulf of Mexico. Density and abundance estimates were derived from NMFS aerial surveys (Davis et al., 2000).

Table 3-8. Sea Turtle Statistics from Surveys of the Continental Shelf and Slope (1996-98)

Shelf	**Number Sighted**	**Individuals/100 km^2**	**Abundance Estimate**
Loggerhead			
Overall	84	4.077	503
Summer	39	3.891	480
Winter	45	4.253	524
Kemp's ridley	2	0.097	12
Leatherback	4	0.194	24
Unidentified	7	0.340	42
Slope	**n**	**D**	**N**
Loggerhead			
Overall	21	0.2	141
Summer	2	0.034	24
Winter	19	0.406	286
Leatherback			
Overall	25	0.238	168
Summer	19	0.327	230
Winter	6	0.128	90
Unidentified	5	0.048	34

Source: Davis et al., 2000

Manatees

The West Indian manatee (*Trichechus manatus*) is federally listed as endangered by the USFWS and also by the Florida Fish and Wildlife Conservation Commission (FWC) (Florida Game and Freshwater Fish Commission, 1994). In 1893, Florida passed a law to protect manatees, which were historically hunted for oil, meat, and leather (USFWS, 1990). In July 1978, the Florida Manatees Sanctuary Act established the entire state as a "refuge and sanctuary for the manatees" (USFWS, 1991). Manatees are herbivorous aquatic mammals; their diet consists mainly of water hyacinth, hydrilla, turtle grass (*Thalassia testidinum*), manatee grass (*Syringodium filiforme*), and shoal grass (*Haladule wrightii*) (USFWS, 1991; U.S. Coast Guard, 1996). They live in coastal regions including bays, rivers, salt marshes, seagrass meadows, and mangroves (USFWS, 1990). Although they usually occur in tropical waters, they have been sighted in northwest Florida. West Indian manatees rarely venture into deeper waters, but have been spotted as far offshore as the Dry Tortugas Islands (U. S. Coast Guard, 1996). For most of the year, they are found throughout south and central Florida, often in conjunction with sea grasses and vascular freshwater aquatic vegetation (MMS, 1990). The distributional range of the majority of West Indian manatees extends from the Suwannee River south to the Chassahowitzka River during summer and winter migrations (Rathburn et al., 1990). Incidental sightings outside of their normal range (north of the Suwannee River) and as far south as Sanibel Island have been documented (Rathburn et al., 1990). Seasonal movements result from the West Indian manatee's intolerance to cold. During cold fronts, they usually move into areas where there are warm-water refuges such as artesian springs and power-plant discharges. During the summer, their habitats are less defined as they have more freedom to move around in warmer waters and search for food (U.S. Coast Guard, 1996).

Birds

The brown pelican (*Pelecanus occidentalis*) occurs within the coastal regions of the Gulf of Mexico and is listed as a species of special concern by the State of Florida (USFWS, 1996). It was formerly listed as endangered in October 1970 (USFWS, 1992). The brown pelican was faced with extinction because of the widespread use of DDT and its effects on the thinning of eggshells. The population has increased since the banning of DDT in 1972 (Udvardy, 1985) and was removed from the Endangered Species List in 1985. Although they are coastal birds, they will sometimes travel 20 miles offshore to find feeding opportunities (Collazo and Klaas, 1986; Fritts et al., 1983).

3.4.7 Special Biological Resource Areas

Special Biological Resource Areas are offshore habitats that contain both unique flora and fauna. These may be areas that are important as feeding grounds, critical habitats, or principal places of productivity in the Gulf of Mexico. They are all unique ecosystems and support a large variety of species, many still unidentified. They can be found on the continental shelf, slope, and deep sea floor within the eastern Gulf. The eastern Gulf also contains many hard-bottom areas, which typically consist of a hard substrate of living and non-living carbonate reef structures. Although scattered regions of hard bottoms exist throughout the continental shelf and shallower slope areas of the eastern Gulf, the only hard-bottom area to be discussed will be the Florida Middle Grounds. Seagrass beds are another important habitat for numerous species that occur within the Gulf; however, they are not present in the waters of the eastern Gulf and will not be addressed in this section.

The Florida Middle Grounds

The Florida Middle Grounds, the principal hard-bottom in the eastern Gulf, is located approximately 100 miles west-northwest of Tampa (28^{o}15'-45" N: 84^{o}00'-25" W). It rises from a depth of about 100 feet and its shallowest portion is approximately 75 feet deep. The most productive areas encompass 29,963 acres. It lies between three bodies of water: the Gulf Loop Current, west Florida estuarine waters, and the Florida Bay waters (Chew, 1955; Austin, 1970; Smith et al., 1975; USEPA, 1994). It is the most biologically developed live bottom in the eastern Gulf and is the northernmost extent of coral reefs in the Gulf (Bright and Jaap, 1976; Rezak and Bright, 1981). These live bottoms are able to support such a variety of species because of the intrusion of the Loop Current and its high organic productivity.

The Florida Middle Grounds are similar to a typical Caribbean reef community; however, species differ between the two communities. It is a habitat for as many as 197 species of fish. Invertebrates including hard and soft corals, sponges, algae, and anemones inhabit the area as well (Hopkins et al., 1977; Rezak and Bright, 1981). The Florida Middle Ground reefs are comprised of the hydrocoral *Millepora*, the scleractinians *Porites* and *Oculina*, the alcyonarian *Muricea*, and the scleractinian *Dichocoenia* (Hopkins, 1974). Other cnidarians that are present include the alcyonarians *Eunicea, Pseudopterogorgia, Plexaura* and *Plexaurella*, the scleractinians *Stephanocoenia, Scolymia, Agaricia, Helioseris, Madracis, Manicina, Mycetophyllia,* and *Solenastrea*, the actinarians *Condylactis* and *Stoichactis*, and the zoanthidean *Palythoa* (Smith et al., 1975). The Gulf of Mexico Fishery Management Council has designated the area as a Habitat of Particular Concern (HAPC) (50 CFR 638). Fishing the coral is prohibited except as authorized by permit issued under 50 CFR 638.4. Within this area, the use of bottom longlines, traps, pots,

and bottom trawls is prohibited unless authorized by a permit from the NMFS (USEPA, 1994). Rezak and Bright (1981) documented that the Florida Middle Grounds are sensitive to environmental change as are most coral reef systems (Odum, 1971).

Sargassum Community

Sargassum, or Gulfweed, a dominant genus in shallow waters, is a free-floating brown algae that is present in the tropics and subtropics including the Gulf. The *Sargassum* mats drift in oceanic eddies, which have not broken off from over-mature plants. These mats provide an important niche for numerous species and support a community of animals found nowhere else. Fishes occupying the upper water column (0 to 200 meters) use *Sargassum* clumps for food while others lay their eggs in *Sargassum* (Adams, 1960; Bortone et al., 1977; Dooley, 1972; Smith, 1973). Between 1971 and 1976, 15 families and 40 species of fish were collected at 62 *Sargassum* locations within the eastern Gulf (Bortone et al., 1977). Sea turtle hatchlings also use *Sargassum* as a vehicle for passive migration and shelter (Collard and Ogren, 1990). The abundance of invertebrate fauna that inhabit the mats is an important food source for sea turtles (Carr and Meylan, 1980; Carr, 1987). The biomass of *Sargassum* has been decreasing in the Gulf and some believe it is due to human pollutant sources, such as oil spills and contaminant transport (Stoner, 1983). It has been shown that *Sargassum* can accumulate hydrocarbons and some toxic metals (Burns and Teal, 1973; Johnson and Braman, 1975). A decrease in this resource could have a devastating effect on the multitude of species that depend on it for survival.

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to assess potential impacts to Essential Fish Habitat for commercial fisheries managed by the NOAA Fisheries. Essential Fish Habitat is described as those waters and substrate necessary for fish spawning, feeding, or growth to maturity. Some potential threats to essential fish habitat are certain fishing practices, marina construction, navigation projects, dredging, alteration of freshwater input into estuaries, and runoff. Many commercial species are migratory, moving from estuaries to open Gulf waters, or up and down the coast with the seasons. Numerous species pass through or occur in the region and thus the essential habitat of one commercial fish species or another at any given time of the year may fall within the EGTTR (Gulf of Mexico Fishery Management Council, 1998).

Essential fish habitat has been identified by the NMFS for several species within the EGTTR; these species and their habitat by life stage are presented in Table 3-9.

Table 3-9. Managed Species for which Essential Fish Habitat has been Identified in the EGTTR

Species	Life Stages	Habitat
Black Grouper	Adult, juveniles/subadults, larvae, eggs (spawning area)	Hard bottom; shore to 150 m
Brown Shrimp	Adult	Soft bottom; estuarine dependent
Cobia	Adult, juveniles/subadults, larvae, eggs (spawning area)	Pelagic; drifting or stationary floating objects
Corals	All life stages	Hard bottom
Sargassum	All life stages	Pelagic
Dolphin (Mahi)	Adult, juveniles/subadults, larvae, eggs (spawning area)	Pelagic; floating objects
Gag Grouper	Adult	Hard bottom
Greater Amberjack	Adult, juveniles/subadults, larvae, eggs (spawning area)	Pelagic and epibenthic; reefs and wrecks; to 400 m
Gray Snapper	Adult	All bottom types; 0 to 130 m
Gray Triggerfish	Adult	Hard bottom
King Mackerel	Adult	Pelagic
Lesser Amberjack	Adult, juveniles/subadults, larvae, eggs (spawning area)	Pelagic
Lane Snapper	Adult, juveniles/subadults, larvae, eggs (spawning area)	Soft and hard bottom; 0 to 130 m
Little Tunny	Adult, juveniles/subadults, larvae, eggs (spawning area)	Pelagic
Pink Shrimp	Adult (spawning area)	Soft and hard bottom; inshore to 65 m
Red Drum	Adult (spawning area)	Soft bottom, oyster reefs, estuarine to 40 m
Red Grouper	Adult, juveniles/subadults, larvae, eggs (spawning area)	Hard bottom; 3 to 200 m
Red Snapper	Adult, juveniles/subadults, larvae, eggs (spawning area)	Hard bottom, pelagic
Scamp	Adult	Hard bottom
Stone Crab	Adult (spawning area)	Soft, hard or vegetated bottom
Spiny Lobster	Adult	Hard bottom
Spanish Mackerel	Adult, juveniles/subadults, larvae, eggs (spawning area)	Pelagic; inshore to 200 m
Tilefish	Adult (spawning)	Soft bottom, steep slopes; 80 to 540 m
Vermillion Snapper	Adult, juveniles/subadults, larvae, eggs (spawning area)	Hard bottom; 20 to 200 m
White Shrimp	Adult, juveniles/subadults, larvae, eggs (spawning area)	Soft bottom; inshore to 40 m
Yellowtail Snapper	Adult, juveniles/subadults, larvae, eggs (spawning area)	Hard bottom; 0 to 180 m

Source: Gulf of Mexico Fishery Management Council, 1998; NOAA Data Atlas, 1985

3.5 RESTRICTED ACCESS/SOCIOECONOMICS

The following sections describe socioeconomic conditions within the study region including commercial and recreational fisheries, commercial shipping, commercial air traffic, military

activity, energy exploration and development, recreational activities, and cultural and historical regions.

The EGTTR is composed of Warning Areas 151, 168, 174, and 470 plus the individual Eglin Water Test Areas (EWTAs) 1 through 6. The areas of concern for this project are Warning Area 151A and Warning Area 151B, which are components of Warning Area 151. The Warning Areas and EWTAs only include the airspace. There are no restrictions on public or commercial use of the surface waters. The Warning Areas altitudes and activation periods are defined in Federal Aviation Administration (FAA) Handbook 7400.8B. These areas are restricted to Department of Defense (DoD) use except when the airspace-controlling agency either authorizes joint use or turns the airspace over to FAA control. The EWTAs are governed by a Letter of Agreement between Jacksonville, Houston, and Miami ARTC Centers (ARTCCs), Training Air Wing Six (Navy Pensacola), and the Air Force Air Armament Center (Eglin AFB), and are only activated upon request. All requests must give at least two working days notice prior to activation. Once activated, they carry the same restrictions as any Warning Area plus those included in the Letter of Agreement. A Warning Area restricts all public and commercial use of the airspace due to the hazardous nature of military testing and training.

There are no restrictions on public or commercial uses of the surface water under the Warning Areas unless this activity also requires airspace or other DoD activities are planned. These activities must then be scheduled through the controlling agency for that airspace. Other DoD activities primarily involve Navy operations utilizing surface waters for testing and training. Naval support vessels or helicopters may temporarily clear surface waters of any public or commercial traffic. If there is an activity that could be hazardous to public or commercial use of the surface, a local NOTMAR notification will be made through the U.S. Coast Guard Service stating the activity and potential hazards. But even with these notices, it is the responsibility of the testing/training activity to ensure that there is no surface traffic in the area. If there is, aircrews must wait until the area is clear or find another location in the EGTTR that is clear of traffic to pursue that activity. Due to the level of cooperation provided by local commercial and public users of the surface and the offshore nature of EGTTR waters, only one test in the past seven years has required rescheduling.

3.5.1 Recreation

The northern Gulf of Mexico coastal zone is one of the major recreational regions of the United States, particularly for marine fishing and beach activities. Its resources include coastal beaches, barrier islands, coral reefs, estuarine bay and sounds, river deltas, and tidal marshes. Many of these are held in trust for the public under federal, state, and local jurisdiction (i.e., parks, landmarks). Commercial facilities such as resorts and marinas are also primary areas for tourist activity.

Outdoor recreational activity in the Gulf is primarily located along the shoreline and is associated with accessible beach areas. Beaches are a major focal point for tourism as well as a primary source of recreational activity for residents.

Fishing

The Gulf waters are estimated to support more than one third of the nation's marine recreational fishing, with over 2.6 million anglers in 2000, who caught an estimated 149 million fish during more than 20 million individual fishing trips. Nearly 104 million of the fish were caught from private/rental boats, over 7 million were caught from charter boats, and 33 million were caught from the shore (NMFS, 2001). Tourism-related dollars in the Gulf Coast states contribute an estimated $20 billion to the local economy each year (USEPA, 1994). Recreational fishing activities usually occur within three miles of the shoreline, with anglers fishing from shore or from private or charter boats. In Destin, Florida, cobia fishing tournaments may occur in late March and April, and an annual billfishing tournament occurs in October. Cobia are fished from wrecks and artificial reefs beginning in late March. In 2000, there were 35,000 participants in the October billfishing tournament over the month long period. Table 3-10 shows the marine recreational fishing statistics for Gulf coast states in 2000.

Table 3-10. Marine Recreational Fishing Statistics for Gulf Coast States in 2000

State	No. of Fishermen	No. of Fishing Trips	No. of Fish Caught
Alabama	346, 885	1,096,852	7,471,949
Louisiana	699,540	3,653,903	39,219,520
Mississippi	223,280	1,060,902	4,910,520
West Florida	3,599,022	14,625,831	97,416,750

The Florida Gulf coast, and particularly southwest Florida, boasts diverse habitats that support several species of fish and invertebrates favored by tourist and resident fishermen (ESE et al. 1987). In 1988, estimates put recreational angling expenditures in the Gulf of Mexico at $6.5 billion and output at $10 billion, creating 187,000 jobs. Florida and Texas were by far the leaders among the five states. In west Florida, expenditures from sport fishing were $3.1 billion with an output of $4.2 million in 1988. Florida has 1,051 party and charter boats, more than all the other coastal states from Texas to North Carolina combined. Registered boats (less than 5 net registered tons) reached 9,409 in 1992 and rose to 9,444 in 1993. Over 75 million pounds of fish were caught recreationally in 2000, with popular species being herring, seatrout, catfish, and flounder (Table 3-11) (NMFS, 2001).

Species targeted by recreational anglers are generally the same targeted by the commercial fishing industry, and may be grouped as inshore, coastal pelagic, reef fishes, and offshore pelagics. Inshore species include red drum, spotted sea trout, snook, striped or black mullet, tarpon, pompano, black drum, and sheepshead. Most of these inshore species are primarily sought by recreational fishermen, with the exception of mullet and sea trout. Anglers seeking reef fishes capitalize on the abundance of larger predatory species such as snappers, groupers, grunts, porgies, barracudas, and jacks. Certain ornamental reef fishes such as angelfishes, butterflyfishes, damselfishes, gobies, and small seabass are sought for the aquarium industry. Billfish, dolphinfish, and tuna are offshore pelagics, generally fished commercially. Invertebrate species fished in the northeast Gulf are scallops, oysters, and blue crab, while lobster, stone crab, and pink shrimp are fished in southwest Florida waters.

Table 3-11. Estimated Total Number of Fish Caught by Marine Recreational Anglers in the Gulf of Mexico by Species Group, January -December 2000

Species Group	Thousand Pounds
Herrings	23,365
Spotted Seatrout	27,622
Saltwater Catfishes	8,941
Flounder	1,023
Red Drum	8,511
Sand Seatrout	5,934
Atlantic Croaker	5,935
Black Sea Bass	3,378
White Grunt	2,591
Red Snapper	2,182
Mullets	2,973
Kingfishes	2,411
King Mackerel	449
Bluefish	375
Spot	73
Other Fishes	53255
TOTAL	**149,018**

Source: Modified from NMFS, 2001

Saltwater fishing activities, both commercial and recreational, are essential for the social and economic welfare of the citizens of the Gulf coast. Greene, Moss, and Thunberg (1994) estimated the recreational reef fishery alone in Florida generates $385.6 million in total expenditures annually, approximately $12 million of which is derived from saltwater fishing license fees. Their study quantified the effects of declining catches, estimating a 20 percent reduction in average catch would reduce expenditures from saltwater anglers by $32.1 million. In 1988, the Sport Fishing Institute estimated resident and tourist sport fishermen from the five Gulf states spent $6.5 billion, generating a total economic output of $10 billion (MMS, 1990).

Recreational fishing activities also include fishing from charter boats that occasionally go into deeper waters. Party boats fish primarily over offshore hardbottom areas, wrecks, or artificial reefs for amberjack, barracuda, groupers, snapper, grunts, porgies, and sea basses. In addition, charter boats and party boats operating out of Key West frequently fish the Dry Tortugas area for grouper and snapper (ESE et al., 1987). In the Florida Keys alone, in 1984, there were 86 charter boats and 24 party boats compared to 215 charter boats and 24 party boats in operation on the entire west Florida coast. Ninety percent of all sport fishing in the Keys takes place via charter boat from December 15 to April, after which boat captains turn their focus to commercial fishing (SAIC, 1995).

Boating

Recreational boating interests include the use of sailboats, powerboats, and personal watercraft on freshwater lakes, inlets, estuaries, sounds, and in the Gulf. These watercraft activities lie almost entirely within three miles of the shoreline, limiting conflicts with military activities. A survey of the number of powerboats, sailboats, and personal watercraft registered along the Florida Gulf coast shows the distribution of recreational boating activity along the shoreline (Table 3-12).

Table 3-12. Distribution of Recreational Watercraft Among Florida Gulf Coast Counties

County	All Boats	Powerboats		Sailboats		Personal Watercraft	
		Pleasure	Commercial	Pleasure	Commercial	Pleasure	Commercial
Bay	16,445	14,759	1,457	227	2	1,301	524
Escambia	16,783	15,977	487	314	5	1,060	77
Franklin	2,362	1,502	827	32	1	24	0
Gulf	2,376	2,112	259	5	0	28	8
Okaloosa	15,977	14,870	822	276	9	1,652	297
Santa Rosa	8,870	8,415	325	130	0	359	87
Walton	2,673	2,572	84	17	0	27	4
TOTAL	**65,486**	**60,207**	**4,261**	**1001**	**17**	**4,451**	**997**

Source: Florida Department of Transportation, 1996

3.5.2 Commercial Fishing

The Gulf of Mexico is the single most important commercial fishing area in the United States (U.S. Department of Commerce, 1998). Commercial fishing in the Gulf of Mexico in 2000 produced over 1.79 billion pounds valued at over $990 million (Davis et al., 2000). Florida's west coast ranked third among the Gulf states of Louisiana, Mississippi, Texas, and Alabama with over 75 million pounds valued at $156 million. The major commercial ports and their dominant fisheries along the Gulf coast of Florida are Apalachicola (oysters/shrimp) with 10.3 million pounds valued at $11.4 million in 2000, Fort Myers (black mullet/shrimp) with 7.9 million pounds valued at $16.5 million in 2000, and Key West-Marathon (shrimp/lobster/king mackerel) with 16.9 million pounds valued at $50.6 million in 2000 (NMFS, 2001). Commercial fishing is generally concentrated along the coastline and extends west covering approximately one-half of the over water ROI.

Commercially Important Species

Commercial fisheries are a valuable industry in northwest Florida, worth over $3.5 million in 1997 from Gulf County alone (FDEP, 1998). The estimated number of fishing vessels operating in Florida waters decreased from 2,264 in 1992 to 2,128 in 1993 (Holliday and O'Bannon, 1995), yet the economic contribution from commercial fisheries in and adjacent to the ROI has increased over recent years. In 1995 the economic value was $176 million for 91.2 million pounds of total commercial fishery landings for the west coast of Florida. In 1994 the economic value was $171.4 million for 116.5 million pounds of total landings (Bennett, 1996). However, an even more dramatic difference in economic value is apparent from 1993 when the economic value was $153.5 million for 127.9 million pounds of total commercial fishery landings for the west coast of Florida (Newlin, 1994). The economic contribution from west coast Florida fisheries in 1995 certainly increased from over five years ago when in 1988 the economic value was $131.4 million for 143 million pounds of total commercial landings (USEPA, 1994).

Resources within the EGTTR are more economically important than fishery resources within the three-mile zone from the shoreline to range boundary, which is not considered part of the EGTTR. In 1993, commercial landings from 3 to 200 miles were 69 million pounds, which was 46 percent of total landings from the shoreline to 200 miles. However, the species landed in the EGTTR are more economically profitable. In 1993, the economic value of commercial fisheries from 3 to 200 miles was $106.8 million, which was 70 percent of the total value of all landings from the shoreline to 200 miles (Newlin, 1994).

The following sections describe the most commercially important species. Overall, the shrimp fishery, including pink shrimp, white shrimp, and brown shrimp is the most valuable to the Florida west coast. Other species that are valued over $1 million dollars a year are grouper and scamp, blue crab, striped mullet, and snappers (yellowtail and red) (Table 3-13).

Table 3-13. Commercially Important Fishes within the Eastern Gulf

Common Name	Scientific Name
Sandbar Shark	*Carcharhinus plumbeus*
Dolphinfish	*Coryphaeria hippurus*
Spotted Seatrout	*Cynoscion nebulosus*
Grouper	
Yellowedge Grouper	*Ephinephelus flavolimbatus*
Black Grouper	*Mycteroperca bonaci*
Gag Grouper	*Mycteroperca microlepis*
Scamp	*Mycteroperca phenax*
Yellowtail Snapper	*Ocyurus chysurus*
Shrimp	
Pink Shrimp	*Penaeus duorarum*
White Shrimp	*Penaeus setiferus*
Brown Shrimp	*Penaeus aztecus*
Cobia	*Rachycentron canadus*
King Mackerel	*Scomberomerus cavalla*
Spanish Mackerel	*Scomberomerus maculatus*
Amberjack	*Seriola dumerili*
Yellowfin Tuna	*Thunnus albacares*
Pompano	*Trachinotus carolinus*
Swordfish	*Xiphias gladius*

Source: FDEP, 1998

3.5.3 Commercial Shipping

Seven of Florida's deepwater ports are located on the Gulf: Port of Pensacola, Port of Panama City, Port St. Joe, Port of St. Petersburg, Port of Tampa, Port Manatee, and Port of Key West. Approximately 45 percent of U.S. shipping tonnage passes through Gulf of Mexico ports. Major shipping routes in the Gulf are shown in Figure 3-4. The Gulf of Mexico supports the second largest marine transport industry in the world. In 1999 there were more than 234,000 trips in the Gulf of Mexico. In 1999 over 109.6 million tons of commodities were shipped through the Gulf portion of the Intracoastal Waterway (U.S. Army Corps of Engineers, 1999). There are two deep-water ports in the five county ROI: the Port of Pensacola in Escambia County and Port of Panama City USA in Gulf County. Both of these ports are located along the Intracoastal Waterway.

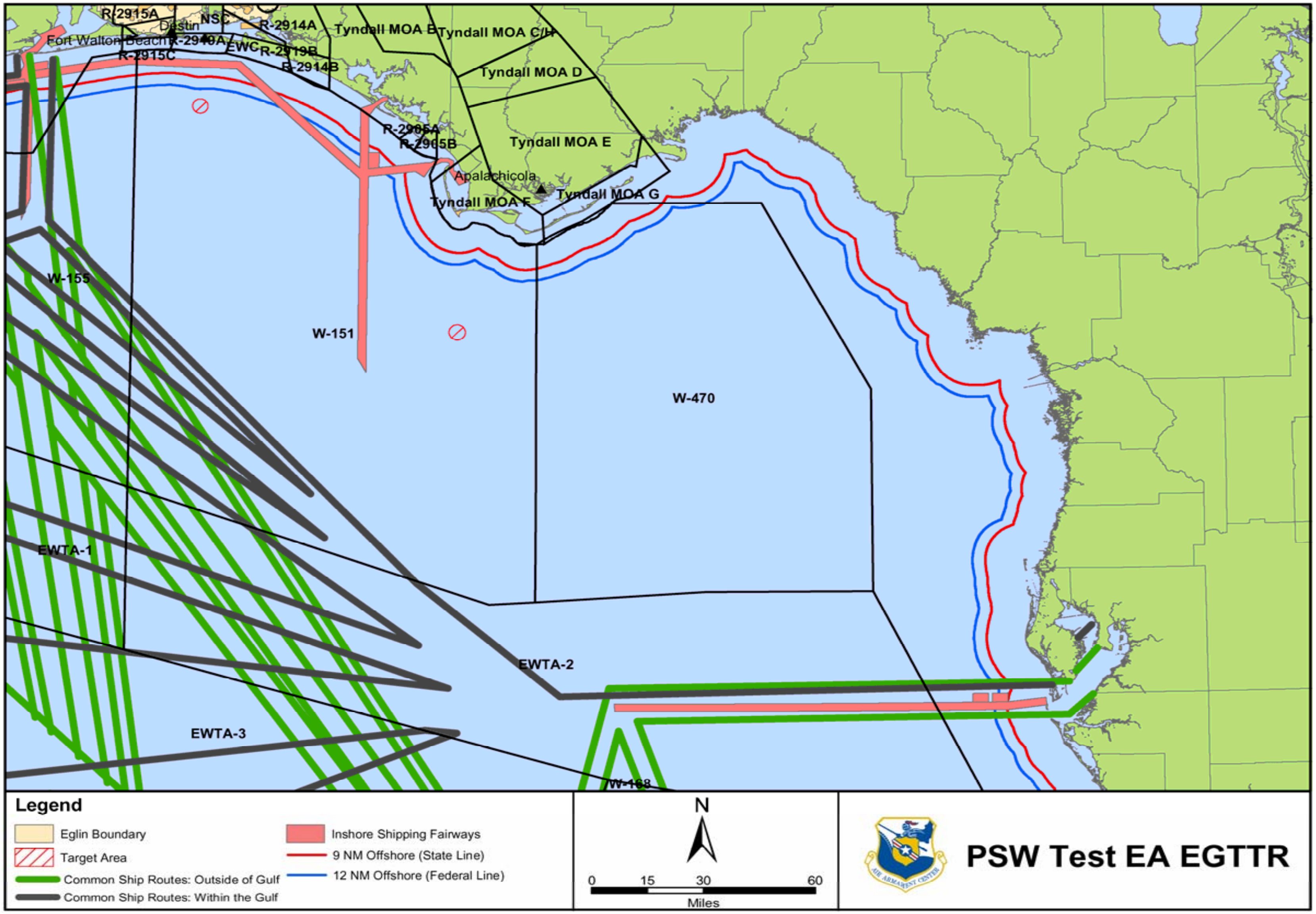

Figure 3-4. Shipping Corridors in the Eastern Gulf of Mexico

The Port of Pensacola is northwest Florida's leading deep-water port and is located on the Gulf of Mexico at latitude 30 degrees, 24 minutes north, longitude 87 degrees, 13 minutes west (11 miles from sea buoy). The port offers stevedoring and marine terminal services for any description of bulk, break-bulk, and unitized freight. Bagged agricultural products, forest products, asphalt, sulfur, lime, steel products, frozen and refrigerated foods and project cargos are a few of the many commodities frequently handled through the Port of Pensacola. For the third year in a row, the Port's operating revenues exceeded its operating expenses. The Port went from an operating deficit of $527,322 in FY1996 to a surplus of nearly $613,000 in FY1998—a gain of over a million dollars in two years. The momentum has continued with an operating surplus every year since. In FY2000, the Port's operating surplus totaled an estimated $600,000. In FY 1998, the latest year for which figures are available, the port provided 588 total jobs, $11.8 million in wages, and $2.1 million in state and local taxes to Escambia and Santa Rosa Counties (Port of Pensacola, 2001).

Port Panama City USA was established in 1967; it contains five deepwater berths and intermodal transportation facilities. Foreign-Trade Zone #65 is also located at the port and provides financial advantages to importers and exporters in the international market. Port Panama City is recognized as a Load Center for liner board and wood pulp. Other commodities shipped through the port include feed products, steel, machinery, and dry and liquid chemicals. Port Panama City handled over 0.9 million short tons of cargo in FY1996/1997, and an estimated 1.1 million tons in FY2001/2002 (Florida Ports Council, 2001).

The total dollar value of Florida's waterborne trade is presented in Figure 3-5.

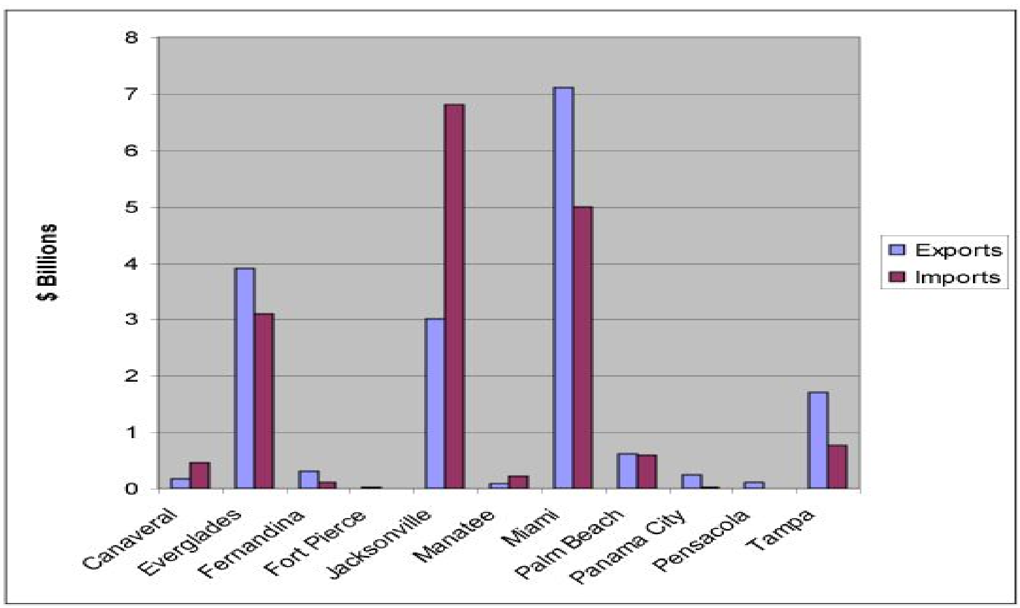

Figure 3-5. Dollar Value of Florida's Total Waterborne Trade (Florida Ports Council, 2001)

The Florida Seaport Transportation and Economic Development Council's latest five-year plan estimates that by 2005, 466,000 jobs, or 6.6 percent of all private sector employment will be attributable to seaport activities. In addition, by 2005, the seaports annual earnings are projected to increase by 68 percent to $11.1 billion; annual business sales are projected to increase by

61 percent to $36.8 billion, and annual state and local taxes will almost double, growing to $1.6 billion (FDOT, 2001).

3.5.4 Oil and Gas Production

The infrastructure for oil and gas production in the Gulf of Mexico is highly developed. This infrastructure includes oil refineries, petrochemical and gas processing plants, supply bases for offshore services, platform construction yards, pipeline yards, and other industry-related installations. Oil and gas refineries, natural gas plants, and petrochemical plants contribute little to the eastern Gulf of Mexico economy. Florida oil production peaked in the 1975-1980 period with just under 50 million barrels produced in 1978 (Florida Geological Survey, 1991). In 2000, oil production reached over 4.6 million barrels and over 605 million cubic feet of gas (Florida Geologic Survey, 2001). There are no active oil and gas producing wells within the Eglin AFB over water area. There are a number of oil and gas leases within this area.

3.6 AIRSPACE

This section discusses the use and management of the airspace, which supports aviation activities over the Gulf of Mexico, in the Eglin Gulf Test and Training Range, and in the military training airspace used by multiple user groups including the U.S. Air Force and the U.S. Navy in cooperation with the JASSM Program in the Precision Strike Weapons Test mission.

Airspace management is defined as the direction, control, and handling of flight operations in the volume of air that overlies the geopolitical borders of the United States and its territories. Airspace is a resource managed by the FAA, which has established policies, designations, and flight rules to protect aircraft in the airfield and in the enroute environment, and in special use airspace areas identified for military and other governmental activities. Management of this resource considers how airspace is designated, used, and administered to best accommodate the individual and common needs of military, commercial, and general aviation. Because of these multiple, and sometimes competing demands, the FAA considers all aviation airspace requirements in relation to airport operations, Federal Airways, Jet Routes, military flight training activities, and other special needs to determine how the National Airspace System (NAS) can best be structured to satisfy all user requirements.

The FAA has designated four types of airspace above the United States. They are: Controlled, Special Use, Other, and Uncontrolled airspace.

- Controlled airspace is categorized into five separate classes: Class A, B, C, D, and E airspace. These classes identify airspace that is controlled, airspace supporting airport operations, and designated airways affording enroute transit from place-to-place. They also indicate pilot qualification requirements, rules of flight that must be followed, and the type of equipment necessary to operate within that airspace.
- Special Use Airspace (SUA) is designated airspace within which flight activities are conducted that requires confinement of participating aircraft, or places operating limitations on non-participating aircraft. Prohibited Areas, Restricted Areas, Warning Areas, and Military Operations Areas (MOAs) are examples of SUA.

- Other airspace consists of advisory areas, areas that have specific flight limitations or designated prohibitions, areas designated for parachute jump operations, Military Training Routes (MTRs), and Aerial Refueling Routes (ARs).
- Uncontrolled airspace is designated Class G airspace and has no specific prohibitions associated with its use.

3.6.1 Federal Regulations

Executive Order 10854 extends the responsibility of the FAA to the overlying airspace of those areas of land or water outside the jurisdictional limit of the United States. Under this order, airspace actions must be consistent with the requirements of national defense, must not be in conflict with any international treaties or agreements made by the United States, nor be inconsistent with the successful conduct of the foreign relations of the United States. Accordingly, actions concerning airspace beyond the jurisdiction limit (12 nautical miles) require coordination with the FAA, the DoD, and the Department of State.

Part 5 of FAA Order 7400.2E contains the policy, procedures, and criteria for the assignment, review, modification, and revocation of special use airspace overlying water (i.e., warning areas). A warning area is airspace of defined dimensions over international waters that contain activity that may be hazardous to nonparticipating aircraft. The term “warning area” is synonymous with the International Civil Aviation Organization (ICAO) term “danger area” (Federal Aviation Administration, 2001a).

3.6.2 U.S. Air Force Regulations

U.S. Air Force airspace management is prescribed by the U.S. Air Force Instruction (AFI) 13-201, *U.S. Air Force Airspace Management* (20 March 2001), which applies to all active duty, reserve, and Air National Guard units having operational and/or administrative responsibilities for using airspace and navigational aids. This policy applies to each Major Command (MAJCOM) functioning as the U.S. Air Force component of a unified command and to specified commands as outlined in unified or specified command directives. AFI 13-201 covers aeronautical matters governing the efficient planning, acquisition, use, and reporting of airspace actions to support U.S. Air Force flight operations.

3.6.3 Environmental Actions

AFI 13-201 contains policy that all airspace actions are subject to environmental analysis in order to comply with the National Environmental Policy Act (Public Law 91-190) as implemented in 32 CFR 989, 2003, *The Environmental Impact Analysis Process (EIAP),* March 2003. The procedures to implement NEPA and the CEQ regulations regarding the establishment, designation, and modification of special use airspace are contained in a Memorandum of Understanding between the FAA and the DoD contained in FAA Handbook 7400.2.

32 CFR 989, 2003, contains policies, responsibilities, and procedures for the U.S. Air Force Environmental Impact Analysis Process within the United States, its territories, and abroad, applying to all U.S. Air Force activities and the Air National Guard. Airspace-related actions

conducted within the United States and its territories that qualify for categorical exclusions (CATEXs) from environmental review include:

- Relocation of a small number of aircraft to an installation with similar aircraft that does not result in a significant increase of total flying hours or the total number of aircraft operations, a change in flight tracks, or an increase in permanent personnel or logistics support requirements at the receiving installation.
- Temporary (for less than 30 days) increases in air operations up to 50 percent of the typical installation aircraft operation rate, or increases of 50 operations a day, whichever is greater.
- Flying activities that comply with the federal aviation regulations, that are dispersed over a wide area, and that do not frequently (more than once a day) pass near the same ground points. This CATEX does not cover regular activity on established routes or within special use airspace.
- Supersonic flying operations over land and above 30,000 feet mean sea level (MSL), or over water and above 10,000 feet MSL and more than 15 nautical miles from land.
- Formal requests to the FAA or host-nation equivalent agency to establish or modify special use airspace (for example) and military training routes for subsonic operations that have a base altitude of 3,000 feet above ground level or higher. The environmental planning function (EPF) must document application of this CATEX on AF Form 813, which must accompany the request to the FAA.
- Adopting airfield approach, departure, and en route procedures that do not route air traffic over noise-sensitive areas, including residential neighborhoods or cultural, historical, and outdoor recreational areas. The EPF may categorically exclude such air traffic patterns at or greater than 3,000 feet above ground level regardless of underlying land use.
- Participating in “air shows” and fly-overs by U.S. Air Force aircraft at non-Air Force public areas after obtaining FAA coordination and approval.
- Conducting U.S. Air Force “open houses” and similar events, including air shows, golf tournaments, home shows, and the like, where crowds gather at an U.S. Air Force installation, so long as crowd and traffic control, etc., have not in the past presented significant safety or environmental impacts.

All other airspace-related actions that have the potential to significantly affect the environment are subject to a higher level of environment review (environmental assessment or environmental impact statement), under the provisions of 32 CFR 989, 2003.

3.6.4 Over Water Airspace

Eglin AFB controls 127,868 total square miles (mi^2) of airspace, of which 2.5 percent (3,226 mi^2) is over land and 97.5 percent (124,642 mi^2) is over water. Eglin AFB supported over 73,000 air operation sorties (an individual flight of one aircraft) during FY2000, which were accomplished predominately over the eastern Gulf of Mexico. This over water airspace is referred to as the Eglin Gulf Test and Training Range and is under the authority of the FAA, but is scheduled and operated

by Eglin AFB. The EGTTR is composed of DoD controlled airspace and FAA controlled airspace available on request with an established Letter of Authorization. The EGTTR is sometimes referred to as the "Eglin Water Range."

3.6.5 Types of Airspace

Currently, the EGTTR is comprised of Warning Areas W-151, W-168, W-174, and W-470, as well as EWTA 1 through 6. The EGTTR is defined in the AAC Instruction (AACI) 11-201, Air Operations, dated 8 September 2000 (AACI, 2000). This airspace description is further defined in a "Letter of Authorization" between the Jacksonville, Houston, and Miami ARTC Centers, Training Air Wing Six, and AAC, dated (revised) 20 May 1998.

The EGTTR is the DoD's largest water test range in the continental United States. The over water airspace ROI in the Gulf of Mexico, south of Eglin AFB, is divided into three categories: Warning Areas, EWTA, and Controlled Firing Areas (CFA). Figure 3-6 shows the over water airspace ROI. They are essentially the same as Restricted Areas, but with some legal differences (Federal Register, 1996).

- Warning Areas, established beyond the three-mile limit, is airspace that may contain hazards to nonparticipating aircraft. They include W-151 and W-470. Although the activities conducted within Warning Areas may be as hazardous as those in Restricted Areas, Warning Areas cannot be legally designated as such because they are over international waters. Federal Regulation, January 1996, replaced Presidential Proclamation No. 5928, extending the territorial limit from 3 to 12 nautical miles in 1988. Special FAR 53 establishes certain regulatory warning areas within the new (3 to 12 NM) territorial airspace to allow continuation of military activities while further regulatory requirements are determined. Primary purpose of Warning Areas is to warn nonparticipating pilots of the potential danger.
- EWTAs serve the same function as Warning Areas, providing airspace for hazardous aircraft flying operations including air-to-surface, air-to-air, and surface-to-air activities. All of the EWTAs lie outside the 12-mile limit of the National Airspace System and include EWTAs 1, 2, 3, 4, 5, and 6.
- CFAs contain activities that, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the CFA as compared to other special use airspace is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. Use of the Santa Rosa Island Controlled Firing Area requires that the following are also scheduled: R-2915B to ensure airspace will be available to instrumentation flight rules (IFR) traffic flying along the coastline; Shoreline 5 (S-5); and any additional Warning Area(s) airspace as required for the mission.

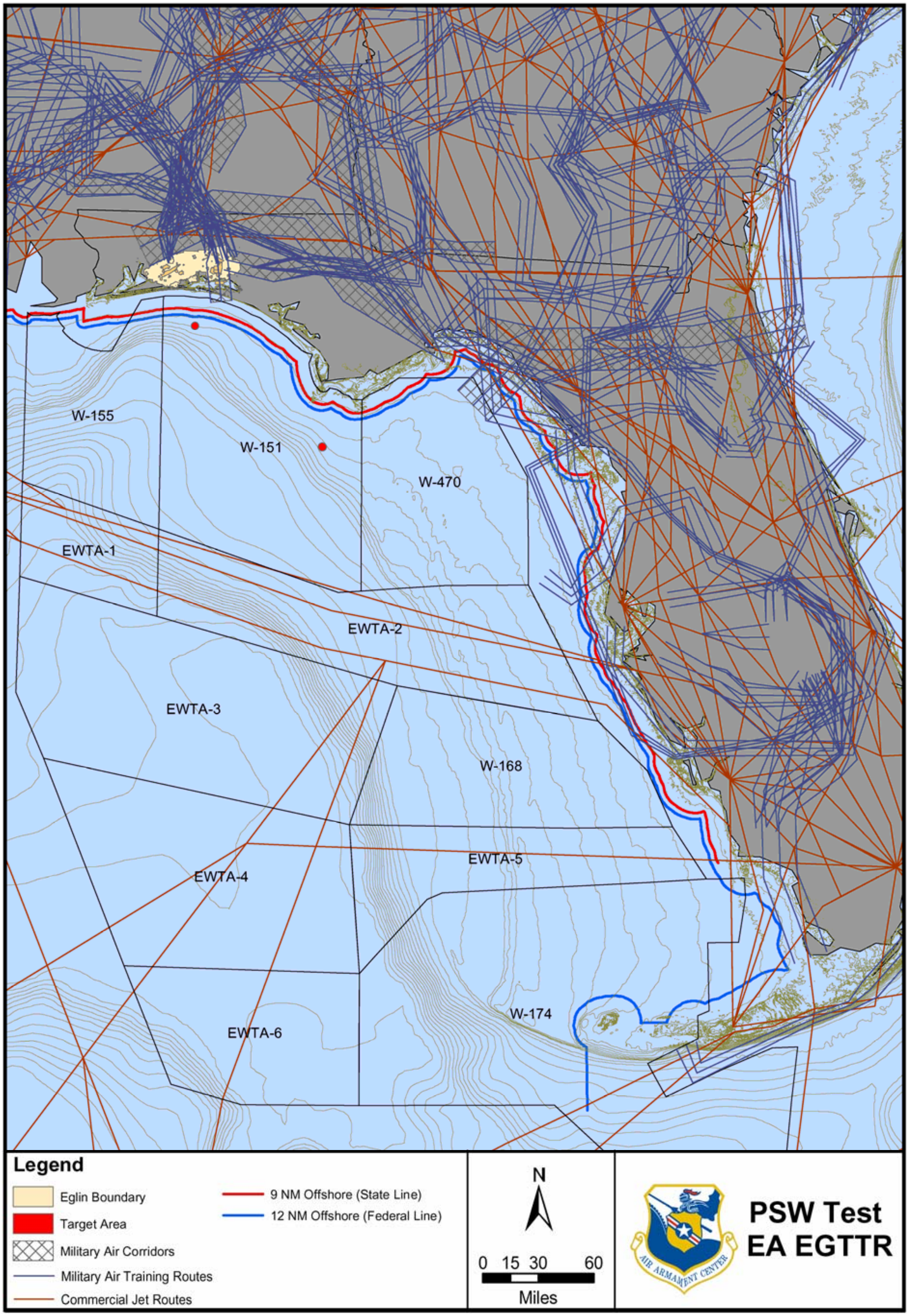

Figure 3-6. Over Water Air Space of the EGTTR

Table 3-14 provides a listing of the relevant Warning Areas, their effective altitudes, times used, and their manager/scheduler.

Table 3-14. Warning Areas in the EGTTR

Airspace	Altitudes (feet)	Time Used		Manager/Scheduler
W-151A-D	Surface to Unlimited	Continuous	1400-0400Z	46 OSS
W-151E-F		Intermittent	Intermittent	

Source: U.S. Government, 2001

3.6.6 Airway/Air Traffic Control

The Warning Areas used by Eglin AFB are surrounded by numerous airways and jet routes that traverse the area. An airway is a control area or portion thereof established in the form of a corridor up to but not including 18,000 feet above mean sea level (MSL), the centerline of which is defined by radio navigational aids. The routes are referred to as "V" routes, or very-high frequency omnidirectional range (VOR) airways over land, and "A" routes or low frequency/medium frequency (LF/MF) airways over water, with numbering to identify the designated route. A jet route is a route designed to serve aircraft operations from 18,000 feet above mean sea level (MSL) up to and including flight level (FL) 450, which is approximately 45,000 feet above MSL. The jet routes are referred to as "J" routes with numbering to identify the designated route. These low-altitude airways and high-altitude jet routes lie within airspace managed by Jacksonville, Atlanta, and Houston Air Route Traffic Control Centers (ARTCCs), or Houston and Miami Oceanic Controlled Areas. Gulf Routes Q-102 and Q-105 are high-altitude oceanic jet routes that allow civilian aircraft to cross EWTAs 1 and 2. The FAA acts as an agent of the ICAO for the over water routes.

3.6.7 Airspace Utilization

Table 3-15 summarizes airspace scheduled utilization and capabilities of the over water airspace in W-151 and W-470, while Table 3-16 summarizes the types of uses and users for this area.

Table 3-15. Airspace Scheduled Utilization and Capability

Airspace/Test Area	Scheduled Hours		Airspace Capability		
	FY 1996	FY 2000	T&E	Training	Space Surveillance
W-151 (A-B-C-D)	30,840 *	43,469 *	X	X	
W-470 (A-B-C)	5,691 *	9,528 *	X	X	

Source: U.S. Air Force, 1998; U.S. Air Force, 2001
* Eglin Range Utilization Report (FY 96 and FY 00), Table 3-18

Table 3-16. Eglin Over Water Airspace Uses and Constraints

Airspace	Land Areas Used	Uses	Constraints
W-151	None	Multi-use air-to-air, air-to-surface, surface-to-air training activities, aircraft flying activities, and T&E activities. Includes aircraft firing activities, watercraft activities, air-to-air missile activities, surface-to-air missile activities, and electronic systems test and training.	Borders coastal restricted airspace requiring close coordination with range safety to ensure weapon safety footprints stay within confines of the airspace during munitions firing/release.
W-470	None	Multi-use air-to-air, air-to-surface, surface-to-air training activities, aircraft flying activities, and T&E activities. Includes aircraft firing activities, watercraft activities, air-to-air missile activities, surface-to-air missile activities, and electronic systems test and training. The Air Combat Maneuvering Instrumentation (ACMI) is located in W-470 A.	Primary user is 325 FW training F-15 pilots. F-22 training will begin later this decade. Non-training user events must coordinate their schedule requirements with 325th FW.

Source: U.S. Air Force, 2001a (Eglin AFB Mission Summary Report)

Warning Area W-470 is used primarily for aircraft training activities for the 33rd Fighter Wing and the units at Tyndall AFB. Most flight activities over the eastern Gulf of Mexico occur between 0700 and 1700 and from dusk to 2300 hours. The majority of flight hours over the Gulf of Mexico are used in support of proficiency and initial training for pilots.

3.6.8 Other Associated Airspace

At Tyndall AFB, the Tyndall Terminal Area (TTA) is that airspace delegated to the Tyndall Radar Approach Control Facility (RAPCON) through a Letter of Authorization (LOA) with Jacksonville ARTCC to provide Air Traffic Control (ATC) services for arriving and departing aircraft. In addition to the controlled airspace around the airfield, the TTA also includes regional SUA (Tyndall AFB Instruction 11-401, 1997). SUA in the TTA includes Restricted Areas, Warning Areas, and MOAs. The TTA airspace extends from the surface to and including flight level (FL) 230, which is approximately 23,000 feet above mean sea level (MSL). The FAA has designated Class D airspace around Tyndall AFB to support airfield operations. The Tyndall RAPCON provides ATC services and manages air traffic within this airspace. This airspace is circular, with an approximate 5.5-NM radius, and extends from the surface to 2,500 feet. Tyndall's Class D airspace is tangential to the Class D airspace at Panama City Bay County International Airport, which is located approximately 10.5 NM northwest of Tyndall AFB. While no other aviation facilities exist within Tyndall’s controlled airspace, a private sea plane base is located southwest of Panama City Bay County International Airport within its Class D airspace. PSW test missions will all occur over the Gulf at 15 to 24 NM. Therefore, Tyndall’s airspace over land and water will not be impacted by the operations. Figure 3-6 illustrates the major features associated with the airspace in the mission area.

Commercial Air Traffic

Commercial air traffic uses established jet routes that cross portions of the EGTTR. However, commercial air traffic may enter the Warning Areas with permission from the controlling agency (Figure 3-6). The commercial air traffic issues are air quality, restricted access, and noise.

Figure 3-6 shows the network of jet routes and airways in the eastern Gulf. The existence of the Warning Areas in the northern EGTTR necessitates longer flight distances for commercial users. As a result of having to sometimes travel around the EGTTR Warning Areas, fuel costs to commercial users are significantly higher than what they normally would be (Draughon, 1996). However, commercial air traffic is allowed through W470 and W151 during inclement weather. Most commercial flights traveling over the Gulf maintain altitudes between 29,000 and 41,000 feet. The exact number of flights using the various Gulf routes is not recorded; however, routes are most heavily used during the summer (Draughon, 1996).

3.7 SAFETY AND OCCUPATIONAL HEALTH

Safety is the evaluation of risks to public health. With respect to the Proposed Action, risk to the health of military personnel and those measures designed to minimize that risk are also reviewed. For actions occurring in the EGTTR with inherent safety risks, procedures are in place that minimize or eliminate altogether risks to the public. Such measures include the designation of areas as “restricted” or “closed” to the public, either permanently or temporarily. Such closures are driven by the dimensions of the “safety footprint” of a particular action that may have potentially harmful noise, blast, or other effects, or by the existence of unexploded ordnance from historical missions.

3.7.1 Safety Footprints

Safety footprints and their restrictions in the EGTTR vary based on several factors, including weapon type, flight profile, altitude, speed, or flight system of the specified test activity.

When applying the individual weapon safety footprints to the test areas in the EGTTR, it is the policy of the Range Safety Office (AAC/SEU) to apply a safety buffer called the impact limit line. The impact limit line is the outermost boundary of allowable surface impact of items generated by the test. The safety buffer not only protects public users from areas potentially impacted by the test activity, but also buffers the activity from adjacent Gulf uses (e.g., shipping, recreational boating, commercial activities), thereby ensuring public safety and compatible use of the Gulf. The buffer can also attenuate the noise of test area activities, mitigating that impact to adjacent/surrounding user groups.

3.7.2 Safety Regulations

The following list of standards and regulations will apply to safety for the PSW Test under the Proposed Action.

29 CFR 1910; 1996; Occupational Safety and Health Act (OSHA), Standards; Requires that chemical hazard identification, information and training be available to employees using hazardous materials and institutes material safety data sheets (MSDS) that provide this information.

Department of Defense Instruction 6055.9; Establishes safety standards and guidance for personnel and facilities exposed to ammunition and explosives during their development,

manufacturing, testing, transportation, handling, storage, maintenance, demilitarization, and disposal.

Department of Defense Flight Information Publication; Identifies regions of potential hazard resulting from bird aggregations or obstructions, military airspace noise sensitive locations, and defines airspace avoidance measures.

Air Force Instruction 32-7063; 1-Mar-94; Air Installation Compatible Use Zone Program (AICUZ). The AICUZ Study defines and maps accident potential zones and runway clear zones around the installation, and contains specific land use compatibility recommendations based on aircraft operational effects and existing land use, zoning, and planned land use.

Air Force Manual 91-201; 12-Jan-96; Explosives Safety Standards; Regulates and identifies procedures for explosives safety and handling as well as defining requirements for ordnance quantity distances, safety buffer zones, and storage facilities.

Air Force Instruction 91-301; 1-Jun-96; Air Force Occupational and Environmental Safety, Fire Protection and Health (AFOSH) Program; Identifies occupational safety, fire prevention, and health regulations governing Air Force activities and procedures associated with safety in the workplace.

3.8 CULTURAL RESOURCES

Eglin AFB airspace over the Gulf lies atop submerged prehistoric sites and historic resources such as shipwrecks. The protection of Gulf submerged cultural sites falls within federal and state (9 NM into the Gulf) jurisdiction. The Exclusive Economic Zone (EEZ) extends 200 NM from the shoreline and is under the jurisdiction of the U.S. Department of the Interior (USDOI). Management plans have been developed for the cultural resources within the EEZ of the Outer Continental Shelf (OCS) Region by the Minerals Management Service (MMS) of the U.S. Department of the Interior (USDOI).

There are three main Acts that address submerged cultural resources: the National Historical Preservation Act (NHPA), the Abandoned Shipwreck Act, and the Florida Historical Resources Act. The NHPA (Section 106) of 1966, as amended, applies to submerged as well as terrestrial cultural resources. The Abandoned Shipwreck Act of 1987 (43 U.S.C. 2101-2106) gives the title and jurisdiction over historic shipwrecks to the federal government out to the EEZ. This applies even if the ship is within state waters. Before engaging in an activity that may negatively affect a shipwreck, this Act requires consideration of the effect the activity may have on a shipwreck, often also mandating preservation. The Florida Historical Resources Act protects sites on state-owned land and submerged land within the Gulf. Any excavation or disturbance of a site requires a permit or contract from the Division of Historical Resources, Bureau of Archaeological Research.

3.8.1 Submerged Resources Management

Development of an Eglin Gulf submerged cultural resources plan is underway, but is not yet completed. Eglin Cultural Resources Division is responsible for identifying cultural resources

and impacts in the EGTTR. For the portions of the over water ranges situated outside state waters, the *Handbook for Archaeological Resource Protection* developed by the MMS/OCS, USDOI, contains prehistoric and historic high-probability zones and guidelines for the identification of submerged cultural resources. These guidelines specify the investigation techniques required to identify potential historic and prehistoric resources in the high probability zones. In the absence of management direction specific to Eglin, a review of the identification procedures is useful.

Historic Shipwrecks

Shipwrecks within Eglin test areas were often the result of natural causes such as severe weather. Literature indicates that less than 2 percent of pre-twentieth century ships and less than 10 percent of all ships reported lost in the Gulf between 1500 and 1945 have known locations (MMS, 1990). There are 271 known shipwrecks listed for the panhandle region of Florida, beginning with the sinking of a fleet of Spanish ships in 1553 and ending with the sinking of a hopper barge in 1986.

Sites were selected to avoid known shipwrecks. The Eglin target site is located over 11 miles from the closest known shipwreck, and the Cape San Blas target site is almost 8 miles from the nearest known shipwreck (Figure 3-7).

Prehistoric Sites

Sites that may exist in a high-probability zone may include Paleo-Indian, Archaic, and Early Gulf formational periods (U.S. Air Force, 1996). Because of the gradual rise in sea level, submerged prehistoric sites may be present in the Gulf. Prehistoric peoples had a tendency to settle near and utilize water resources for food, etc. There was a maximum low sea stand around 16,000 BC to a high at 3,000 to 1,000 BC (Coastal Environments, Inc., 1982).

There are two criteria that are used to determine the potential for submerged prehistoric sites: the presence of submerged geologic formations that would have a high probability of associated prehistoric sites and the known natural occurrences that would preserve a site, such as sedimentation and tidal movement. Geologic features in the eastern Gulf (karst topography, relict barrier islands with back barrier bays and lagoons, and coastal dune lakes) are used as indicators of cultural resources and have a high-probability of containing prehistoric sites. The shelf geomorphology across the eastern Gulf is relatively well preserved. The probability for prehistoric sites at the A-13B and D-3 sites is high, but no confirmed sites exist in these areas (NOAA, 1985).

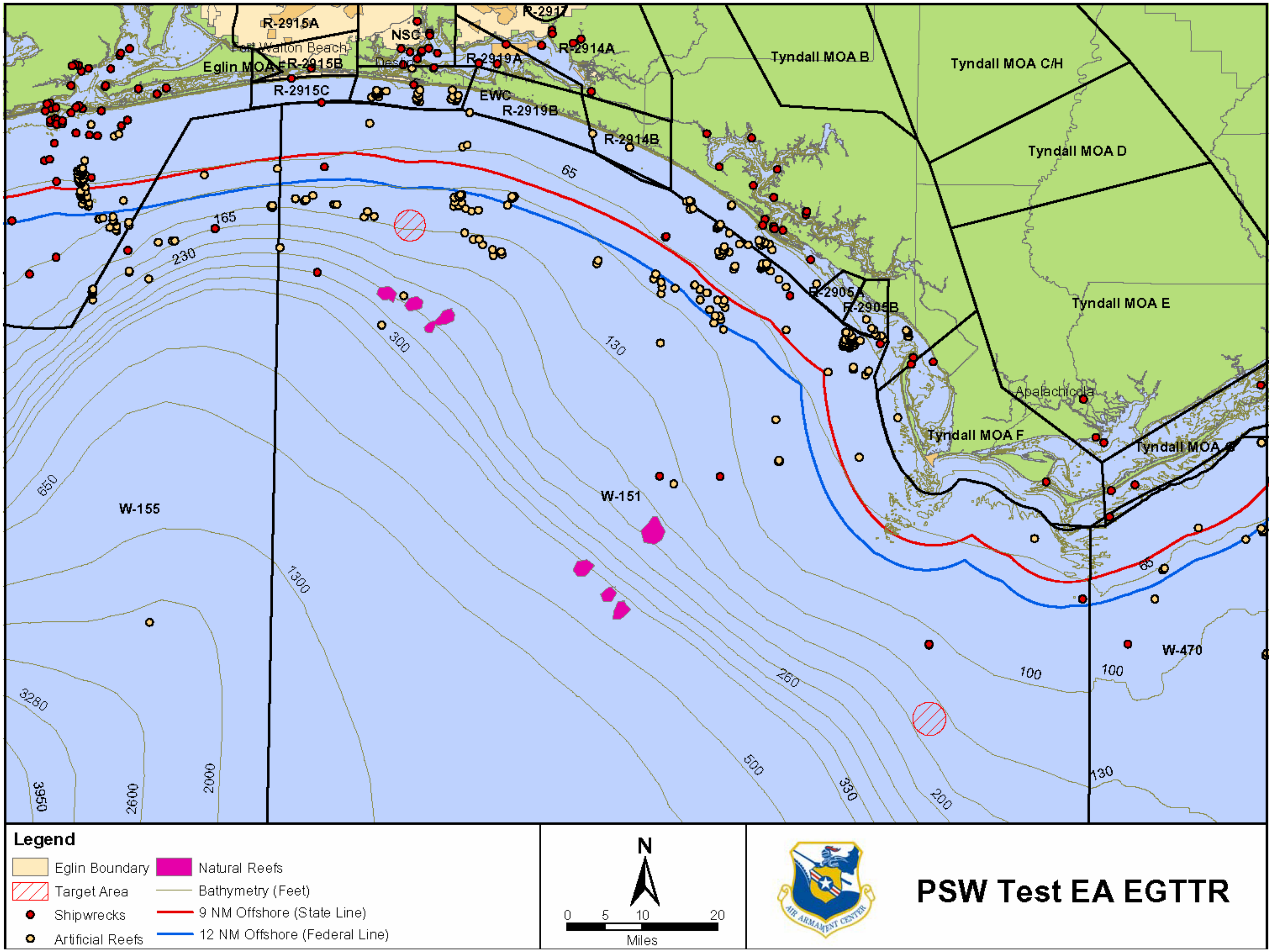

Figure 3-7. Cultural Resources and Hard Bottom Areas near Target Areas in the EGTTR, Florida

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4. ENVIRONMENTAL CONSEQUENCES

This chapter of the assessment presents the anticipated environmental consequences to the affected environment described in Chapter 3. Each alternative action is analyzed for potential impacts to environmental resources. This chapter is organized first by issue or resource and then by alternative.

4.1 WATER QUALITY

This water quality analysis includes potential consequences from debris and chemical materials.

4.1.1 Proposed Action (Preferred Alternative)

The following sections review the impacts of debris and chemical materials resulting from the Proposed Action.

Debris

Eglin AFB testing and training operations result in the generation of a broad variety of expendable materials. Expendables may be downed target drones, discharged chaff and flares, or missiles, bombs, and other exploded/inert munitions remains. The potential adverse effects of the types of debris deposited through EGTTR activities are not well understood. Debris can have negative impacts if ingested by marine animals, or an overall positive impact when providing suitable habitat for fish and invertebrates, as occurs with the placement of artificial reefs. The potential for impact from the EGTTR debris has been analyzed in the EGTTR PEA (U.S. Air Force, 2003).

The debris composition of the JASSM and SDB contains a small variety of individual metal and synthetic materials. The analysis includes the weight of materials contained in live and inert JASSM and SDB ordnance.

The CONEX target consists of 1,000 (5 x 200) 55-gallon steel drums. For analysis purposes it is assumed that the drums are made from 16-gauge, mild steel, weighing 54 pounds each for a total weight of 5,400 pounds. The weight of the hopper barge was calculated using the total surface area multiplied by 10 pounds/square foot (for construction weight steel) to equal 102,000 pounds.

Although it is extremely unlikely that all test items (missiles and targets) will become unrecoverable marine debris, this analysis reflects the entire amount of debris that could potentially enter the GOM from the JASSMs, SDBs, hopper barge, and CONEX during testing activities. Table 4-1 summarizes the debris weight approximations that may occur each year for the Proposed Action in comparison to annual debris approximations for target areas and the entire EGTTR resulting from military activities. Marine expendables were composed primarily of aluminum and steel (Table 4-1) that, once deposited on the bottom, would remain and undergo corrosion. The potential for some pieces to be carried by currents and cause some minimal habitat alteration before becoming embedded in the sediments is remote. The PSW mission team would make every effort to recover surface debris from the target or the weapons following test activities. Every possible attempt that is deemed safe would be made to collect debris. In the

event of a dud weapon, the mission team would make every practical and possible attempt to recover the dud. The possibility of a live-dud is remote because the weapon would be considered a dud after 15 minutes in the water (U.S. Air Force, 2004). Furthermore, the possibility of the test team being unable to recover a live dud is minute.

Table 4-1. Proposed Action Marine Debris (lbs) Composition

Debris Material	Location			Proposed Action Component					Percent Increase		
	W-151A	W-151B	EGTTR	JASSM	SDB	Hopper Barge	CONEX	Total Debris	W-151A	W-151B	EGTTR
Plastic	8,051	11,224	**58,240**	432	19	0	0	451	6	4	1
Steel	72,458	101,017	**521,920**	0	1	102,000	5,400	107,401	148	106	21
Aluminum	326,060	454,575	**2,347,520**	756	315	0	0	1,071	0	0	0
Other*	5,072	7,071	**35,840**	322	328	0	0	650	13	9	2
TOTAL	411,640	573,886	**2,963,520**	1,510	663	102,000	5,400	109,573	27	19	4

*Other = Copper, zinc, lead, and magnesium-thorium

The total weight of solid materials (debris) expended in the EGTTR by Eglin AFB activities from 1995 to 1999 was approximately 2,963,520 pounds. Debris in W-151A and W-151B was 411,640 and 573,886 pounds, respectively. The percent increase from steel debris in the GOM from the Proposed Action is primarily from sinking of the hopper barge, which would reflect over a 100 percent increase in both W-151A and W-151B, and a 21 percent increase for the entire EGTTR over current military activities. While these increases are significant in weight, they add no significant increased potential for environmental impact. The Proposed Action will not significantly increase the amount of plastic, aluminum, or other materials

Debris materials contributed from EGTTR activities were found to be significantly less than materials contributed from nonmilitary activities, such as state and county artificial reef enhancement programs. The cumulative weight of artificial reef materials deposited within W-151A and W-151B and the entire EGTTR are listed in Table 4-2. The materials used in artificial reefs are often similar to the materials found in bombs, the hopper barge, and CONEX target (aluminum and steel).

Table 4-2. EGTTR Artificial Reef Materials and Test Mission Debris under the Proposed Action

EGTTR Areas		**Steel** (tons)	**Aluminum** (tons)	**Plastic** (tons)	**Other** (tons)	**Total** (tons)
W-151A:	Artificial Reef (Total)	1,330	0	4	222	**1,556**
W-151 B:	Artificial Reef (Total)	3,087	0	6	0	**3,093**
Total EGTTR	Artificial Reef (Total)	**43,247**	**600**	**0**	**83,091**	**126,938**
Total Debris Proposed Action		**54**	**0**	**0.22**	**0.32**	**55**

Note: Artificial Reef: Total amount of material deposited as of FY1995 by state and county reef programs.
Other = Copper, lead, zinc, magnesium-thorium

The comparison of types and quantities of Proposed Action activity debris to artificial reef material serves only as a general reference for future comparisons. The Proposed Action represents only 3.5 percent (W-151A), 1.8 percent (W-151B), and 0.4 percent (total EGTTR) artificial reef material deposited by various state and county reef enhancement programs during the same time period. In the short term, concrete, steel, and aluminum debris serve as a substrate for settling and encrusting organisms and thus provide structural heterogeneity to the bottom communities.

The increase in the deposition of iron is not expected to cause the water quality in the Gulf of Mexico, or in the immediate vicinity of the debris, to reach the concentration of 300 micrograms per liter (μg/L) iron that is detrimental to the marine environment. Aluminum from projectiles deposited in the marine or terrestrial environment is not in a chemical form that is readily leached for environmental transport or exposure. The long-term fate of such inert materials is relatively unknown beyond a slow corrosive process. As such, it is not expected that debris would cause adverse impacts to biological resources of the GOM.

Chemical Materials

Chemical materials are introduced into the EGTTR marine environment through drones, gun ammunition, missiles, chaff and flares, and smokes and obscurants. Impacts to water quality and marine organisms may result.

Ordnance

Normal operational deployment of ordnance would result in the combustion of nearly all propellant and explosives. However, it is possible that a weapon that did not function as intended (e.g., a dud) may be released safely (arming function is disabled); thus some amount of explosive material may be introduced into the waters of the EGTTR. However, the toxicological effects of introduced explosives on the affected environment within the EGTTR are minimal. Assuming a maximum dud rate of 5 percent, approximately 900 pounds of explosive material as contained in miscellaneous explosive rounds would be input into the waters of the EGTTR, primarily in W-151. The potential impacts from ordnance were examined in the EGTTR PEA (U.S. Air Force, 2003).

Most explosives used over the EGTTR are composed of TNT, HMX, PBX, or RDX. The properties of AFX-757 are similar to these materials. Aluminum and ammonium nitrate are compounds that are also used in the manufacturing of explosives. Detonation of explosives usually results in complete combustion of the original material and the emission of carbon dioxide, carbon, carbon monoxide, water, and nitrogen oxides. Although none of these chemicals are expected to have significant impacts on the affected environment, a series of calculations will estimate potential quantities of the primary detonation by-products put into the EGTTR waters.

Research has shown that if munitions function properly, full combustion of explosive materials will introduce one-billionth to one-millionth the total weight of raw explosive used during an *open air test* (above water) into the environment. The U.S. Army has developed emission factors (EF) for detonations of various explosives including RDX and TNT. The emission factor is the percentage weight of a chemical compound produced from the detonation of a given source amount of explosive. Explosive by-products with emission factors of 1×10^{-3} or less contribute extremely small amounts of material to the environment. Since a variety of ordnance has been detonated within the EGTTR containing multiple compositions of explosive materials, the emission factors for the primary detonation products of RDX will be used for calculating these estimates. Table 4-3 estimates the total number of pounds of explosive detonation products potentially produced during the Proposed Action in EGTTR W-151A and W-151B.

Table 4-3. Proposed Action Explosive Detonation Products (lbs)

Detonation Products	Emission Factors	W-151A	W-151B	JASSM/SDB at W-151A or W-151B Target
NEW as RDX		7177.1	3931.9	740.0
Carbon dioxide (CO_2)	0.57	4,090.95	2,241.18	421.8
Carbon monoxide (CO)	0.031	222.49	121.89	22.94
Nitrogen dioxide (NO_2)	0.0006	4.31	2.36	0.44
Nitrogen oxides (NO_x)	0.0009	6.46	3.54	0.67

In order to evaluate a potential concentration of explosive detonation products added to the GOM waters during JASSM and SDB testing activities, an exercise incorporating a similar treatment of the "closed box assessment" has been utilized.

The Closed Box Assessment

The "closed box assessment" provides a means to estimate maximum potential impacts from explosive detonation products within a given volume of EGTTR target water range. Several assumptions are incorporated into this technique. First, it assumes that the explosive detonation products are identically mixed and contained within a defined volume of the target area. For these assessments, the volume of each EGTTR water area is described by a depth boundary of approximately 100 feet that is defined by the minimum target area depth. A cylindrical volume was calculated using the 100-foot depth and a target radius of 10,527 feet (2 miles) in the EGTTR for model calculations as summarized in Table 4-3. Water volumes and explosive by-products for W-151A and W-151B were obtained from the EGTTR PEA (U.S. Air Force, 2003).

Second, as a means to estimate the scenario with the maximum amount of products possible, it is assumed that the calculated concentrations of major explosive detonation products within the defined box result from a single detonation event. Although an unlikely scenario, the results demonstrate the extremely small quantities of explosive detonation products added to the waters of the EGTTR. Because of these assumptions, the results of these calculations represent higher water quality impacts than those that would result from a more structured dispersion model. However, the results do provide a maximum impact scenario for comparison.

Table 4-4 estimates the total concentration (micrograms per liter, µg/L, or parts per billion, ppb) of explosive detonation products potentially produced from the Proposed Action and from training and testing within the EGTTR target areas. No criteria standards exist for these compounds in oceanic waters such as the Gulf of Mexico. Carbon compounds such as carbon dioxide and carbon monoxide (and their dissociation products) are associated to the carbonic acid system (carbon alkalinity) whose equilibrium concentrations control the water's alkalinity. The balance between the components of the carbon dioxide equilibria is controlled by the water's pH. The marine waters of the GOM exhibit a strong pH buffering capacity, such that additions of small amounts of acids or bases produce only extremely small changes in pH. An addition of contributions from the Proposed Action of carbon dioxide (0.19417 µg/L) and carbon monoxide (0.01056 µg/L) would produce an immeasurable change in pH, thus a negligible impact.

Table 4-4. Proposed Action Concentrations of Explosive Detonation Products*

EGTTR	W-151A	W-151B	JASSM/SDB at W-151A or W-151B
Volume (L)	**1.17E+14**	**1.04E+14**	**9.85+11**
Detonation Products	**(µg/L)**	**(µg/L)**	**(µg/L)**
NEW as RDX	0.02780	0.01719	0.34065
Carbon dioxide (CO_2)	0.01585	0.00980	0.19417
Carbon monoxide (CO)	0.00086	0.00053	0.01056
Nitrogen dioxide (NO_2)	0.00002	0.00001	0.00204
Nitrogen oxides (NO_x)	0.00003	0.00002	0.00306

* As represented by FY1995 expenditures

Contributions from the Proposed Action do increase detonation products within the target area water column in W-151A and W-151B. However, an addition of contributions from the Proposed Action of nitrogen dioxide (0.00204 µg/L) and other generic nitrogen oxides (0.00306 µg/L) would produce an immeasurable and insignificant change in the total organic and inorganic nitrogen balance of the EGTTR waters. Individual mission contributions would be distributed throughout the year and would therefore constitute an even more negligible impact.

Toxicity of TNT has been well documented. Classified as a possible human carcinogen (Group C by the USEPA), exposure to TNT by humans and other mammals has resulted in pancytopenia, a blood disorder identified by decreased numbers of leukocytes, erythrocytes, and reticulocytes. Liver damage and anemia has also been reported by workers exposed to high levels of TNT. Long-term exposure to atmospheric concentrations of TNT can cause abnormalities in the blood, as well as skin discoloration and abdominal abnormalities.

Potential exposure of humans to these explosive chemicals is expected to be minimal; pilots are well protected in their aircraft, and water traffic is prohibited during test missions. Air exposure to these chemicals by marine mammals is expected to be minimal as well due to the limited amount of time these animals spend on the surface and the quick dispersion of chemical molecules by air currents. Exposure of marine mammals to these chemicals through water is also expected to be minimal (through wave action and tides) and Gulf currents quickly disperse the explosives molecules.

Experiments that demonstrate the toxicity of explosive materials such as RDX, HMX, and PBX to aquatic vertebrates and invertebrates support the conclusion that prolonged exposure (greater than 48 hours) to high level doses of these chemicals (5-100 mg/L) will often produce toxic effects. These effects primarily manifest themselves as deformities or abnormalities rather than occurrences of death. Any exposure of marine vertebrates and invertebrates to these explosive chemicals in the target area would be at low concentrations (0.34065 µg/L) and for a short time period.

JASSM

Materials used to provide corrosion protection of the JASSM system include chromium, cadmium, nickel, or lead. However, the coating system to include the fuselage was tested in accordance with USEPA method 1311 (*Toxicity Characteristics Leaching Procedure*) and was found not to exhibit hazardous characteristics (46 OG/OGMTA, 2003).

The propulsion system uses a Teledyne M370-9-2 turbojet that operates on JP-10 fuel. The fuel tanks hold less than 40 gallons of JP-10 fuel. It is expected that the majority of JP-10 fuel will be expended upon reaching the target and combust upon live detonation. The amount of JP-10 fuel that may potentially enter the GOM from each JASSM (<40 gallons) is negligible.

The thermal battery provides power after missile release and is activated prior to launch. Nickel-cadmium (Ni-Cd) batteries serve as an alternate back-up power source. Potentially six Ni-Cd batteries could be contributed to the GOM; however the addition of this amount of material is insignificant.

All chemicals for the JASSM and SDB introduced to the GOM would be quickly dispersed through wave action, currents, tidal action, and by storm systems that frequently move through the area. Therefore, exposure to chemicals would have no adverse impacts on the affected environment.

4.1.2 Alternative 1: Increased Intensity of Live JASSM Shots

Debris

Alternative 1 will introduce two additional JASSM live bombs into the GOM. Table 4-5 summarizes the debris weight approximations that may occur each year for Alternative 1 in comparison to annual debris approximations for target areas and the entire EGTTR.

Table 4-5. Alternative 1 Marine Debris (lbs) Composition

Debris Material	Location			Alternative 1 Component					Percent Increase		
	W-151A	W-151B	EGTTR	JASSM	SDB	Hopper Barge	CONEX	Total Debris	W-151A	W-151B	EGTTR
Plastic	8,051	11,224	**58,240**	576	19	0	0	595	7	4	1
Steel	72,458	101,017	**521,920**	0	1	102,000	5,400	107,401	148	106	21
Aluminum	326,060	454,575	**2,347,520**	1008	315	0	0	1,323	<1	<1	<1
Other*	5,072	7,071	**35,840**	430	328	0	0	757	15	11	2
TOTAL	411,640	573,886	**2,963,520**	1,510	663	102,000	5,400	110,077	27	19	4

*Other = Copper, zinc, lead, and magnesium-thorium.

The addition of two JASSM live bombs does not significantly increase the amount of plastic, steel/iron, aluminum, or other materials in W-151A or W-151B over the amounts identified for the Proposed Action. Therefore, potential impacts are similar to the Proposed Action and impacts to biological resources are not anticipated.

Additionally, two more JASSM bombs over the Proposed Action do not change the total (tons) of debris material in the target areas. Potential impacts from Alternative 1 debris compared to artificial reef materials are the same as those for the Proposed Action.

Chemical Materials

Table 4-6 estimates the total number of pounds of explosive detonation products potentially produced with the addition of two JASSM live bombs proposed for Alternative 1 within EGTTR W-151A and W-151B. As with the Proposed Action, these products were used to calculate contributions to the GOM within the W-151A and W-151B target areas.

Table 4-6. Alternative 1 Explosive Detonation Products (lbs)

Detonation Products (pounds)	EF	W-151A	W-151B	JASSM/SDB at W-151A or W-151B Target
NEW as RDX		7177.1	3931.9	1250.0
Carbon dioxide (CO_2)	0.57	4,090.95	2,241.18	712.5
Carbon monoxide (CO)	0.031	222.49	121.89	38.75
Nitrogen dioxide (NO_2)	0.0006	4.31	2.36	0.75
Nitrogen oxides (NO_x)	0.0009	6.46	3.54	1.12

Table 4-7 estimates the total concentration (micrograms per liter, µg/L, or parts per billion, ppb) of explosive detonation products potentially produced from Alternative 1 and from training and testing within the EGTTR target areas.

Table 4-7. Alternative 1 Concentrations of Explosive Detonation Products

EGTTR	W-151A	W-151B	JASSM/SDB at W-151A or W-151B
Volume (L)	**1.17E+14**	**1.04E+14**	**9.85+11**
Detonation Products	**(µg/L)**	**(µg/L)**	**(µg/L)**
NEW as RDX	0.02780	0.01719	0.57549
Carbon dioxide (CO_2)	0.01585	0.00980	0.32799
Carbon monoxide (CO)	0.00086	0.00053	0.01783
Nitrogen dioxide (NO_2)	0.00002	0.00001	0.00034
Nitrogen oxides (NO_x)	0.00003	0.00002	0.00051

* As represented by FY1995 expenditures

Contributions from Alternative 1 will increase detonation products within the target area water column in W-151A and W-151B. An addition of contributions from Alternative 1 of carbon dioxide (0.32799 µg/L) and carbon monoxide (0.01783 µg/L), nitrogen dioxide (0.00034 µg/L), and other generic nitrogen oxides (0.00051 µg/L) would produce an immeasurable and insignificant change in the total organic and inorganic nitrogen balance of the EGTTR waters. NEW contributions in the target areas would be at low concentrations (0.57549 µg/L) and for a short time period. Chemicals introduced would be quickly dispersed through wave action, currents, tidal action, and by storm systems, which frequently move through the area. Therefore, exposure to explosive chemicals not fully combusted during normal operations will have minimal to no adverse impacts on the affected environment.

JASSM

A total of eight JASSM per year (40 over five-year plan) would be introduced into the GOM for Alternative 1. Potential impacts from chemical constituents of Alternative 1 JASSM deployment as described above would be the same as the Proposed Action and result in no adverse impacts to the affected environment.

4.1.3 No Action Alternative

The No Action Alternative would not support deployments of JASSM, SDB, or associated target into the EGTTR; thus, no impacts from debris or chemical materials outside of normal operational activities in the area would occur.

4.2 GEOLOGY

4.2.1 Proposed Action (Preferred Alternative)

The Proposed Action supports inert deployments of JASSM and SDB, which are expected to pass through the target and settle on the Gulf floor. Additionally, pieces of a damaged target with inert or live testing could also sink to the bottom and damage sediments, which provide habitat for a variety of organisms. It is possible that in some areas large pieces of debris, such as from targets, could sink to the bottom and potentially damage benthic habitat. As compared to the overall munitions and debris from EGTTR activities, the PSW Tests would contribute a very small amount of debris within this region. Furthermore, no detonations would take place directly on the sediments and impacts would be limited to target and ordnance debris falling to the seafloor.

On-site recovery teams would recover any surface debris following a test event when practicable. This includes recovery of weapon and target pieces. The recovery team would also bring the targets used back to shore following a test when practicable. The targets would be repaired for reuse if feasible, or disposed of through appropriate DoD protocols for disposal.

4.2.2 Alternative 1: Increased Intensity of Live JASSM Shots

The additional live weapons testing proposed by Alternative 1 would produce no significant difference in potential impacts to benthic habitat as described for the Proposed Action. Given the overall small number of shots to be launched over the five-year test plan, the additional detonations are not expected to produce significant damage to the benthic habitat.

4.2.3 No Action Alternative

The No Action Alternative supports current conditions with no additional JASSM/SDB testing. As such, no additional impacts over and above existing operational activities are anticipated.

4.3 NOISE

4.3.1 Proposed Action (Preferred Alternative)

The Proposed Action would produce noise and blast pressures that may potentially affect marine life. Vertebrate species (animals with a backbone) of the affected environment include birds, fish, reptiles (sea turtles), and marine mammals. Plants and invertebrates (e.g. shrimp, jellyfish, squid) also occur within the affected environment and may also be affected.

Potential Impacts to Fish and Bird Species

Potential impacts to fish species are analyzed given the tendency for floating objects to attract fish. The CONEX and barge targets would likely attract fish and bird species. Some effects to fish around the target are anticipated and safe noise impact ranges to fish are estimated using formulas from O'Keeffe and Young (1984).

Table 4-8 gives the "safe ranges" for fish as determined from the thresholds of O'Keefe and Young (1984) and of Christian and Gaspin (1974). Within these ranges, blast effects would be sufficient to cause mortality to fish. Smaller fish are less able to withstand blast pressures than larger fish and fish at the surface are more susceptible to blast pressure than fish at depth (Young, 1991). No assessment of numbers of fish potentially affected can be calculated.

Table 4-8. Proposed Action Safe Range Scenarios for Fish

NEW (TNT) in pounds (lbs)	Depth of Explosion	Range for 1 oz fish (m)	Range for 1 lb fish (m)	Range for 30 lb fish (m)
300	> 20 ft	641	453	292
	1 ft	348	237	131
48	> 20 ft	396	262	157
	1 ft	271	146	78

Some fish mortality is anticipated, but numbers cannot be estimated at this time. Fish attraction to and congregation around floating objects increases with time; thus, the length of time the target is onsite would affect the number of fish exposed to blast effects. Pre-mission activities on the day of testing would startle fish congregations and potentially reduce the number affected by the JASSM shots.

Likewise, impacts to bird species would potentially occur. Seabirds and neotropical migratory birds would likely be attracted to the floating target as a resting place. During spring and fall migrations, the numbers of migratory birds crossing the Gulf of Mexico increases, though major migratory flyways exist further east and further west of the Proposed Action site. Human activity around the floating target prior to the test may serve to keep some birds away or further away from the target, possibly reducing the number injured or killed.

Potential Noise Impacts to Protected Species (Marine Mammals and Sea Turtles)

For the acoustic analysis, the exploding charge is characterized as a point source. The impact thresholds used for marine mammals relate to potential effects on hearing from underwater noise from detonations. All marine mammals are protected under the Marine Mammal Protection Act. The same noise thresholds will also be applied to ESA-listed species of sea turtles. No ESA listed marine mammals would be affected given the location of the Proposed Action on the eastern Gulf of Mexico continental shelf. The nearest ESA listed species, the federal and state endangered sperm whale, occurs further out on the continental slope and in waters generally deeper than 600 meters.

For the explosives in question, actual detonation heights would range from 0 to 25 feet above the water surface, with detonation depths ranging from 0 to 80 feet below the surface. To bracket the range of possibilities, detonation scenarios just above and below the surface were used to analyze bombs set to detonate on contact with the target barge. Potentially the barge may interact with the propagation of noise into the water. However, barge effects on the propagation of noise into the water column cannot be determined without in-water noise monitoring at the time of detonation.

Potential exposure of a sensitive species to detonation noise could theoretically occur at the surface or at any number of depths with differing consequences. As a conservative measure, a

mid-depth scenario was selected to ensure the greatest direct path for the harassment ranges and to give the greatest impact range for the injury thresholds.

Criteria and Thresholds for Impact of Noise on Protected Species

Metrics, criteria and thresholds that are the basis of the analysis of Precision Strike Weapons noise impacts to cetaceans and sea turtles were initially used in U.S. Navy environmental impact statements for ship shock trials of the SEAWOLF submarine and the WINSTON S. CHURCHILL vessel (U.S. Navy, 1998; U.S. Navy, 2001), and adopted by the National Marine Fisheries Service (NMFS, 2001). Details on the metrics, criteria, and thresholds utilized in the analysis are given in Appendix D.

Table 4-9 provides a summary of threshold criteria and metrics for potential noise impacts to sensitive species.

Table 4-9. Threshold Criteria and Metrics Utilized for Impact Analyses

Level A Harassment	Level B Harassment
Injurious; eardrum rupture (for 50% of animals exposed)	Non-injurious; includes temporary threshold shift (TTS) (temporary hearing loss) and biologically significant behavioral disruption
205 dB re 1 μPa^2-s EFD	182 dB re 1 μPa^2-s and 23 psi peak pressure (EFD in greatest 1/3-octave band between 10 Hz and 100 Hz)

Note: See appendix D for harassment definitions.

Risk Estimates

Methodology for Take Estimation

Noise zones of impacts (ZOIs) were calculated for depth detonation scenarios of 1 foot and 20 feet for both Level A and Level B harassment. To determine the number of potential "takes" or animals affected by harassment, sea turtle and cetacean population information from ship and aerial surveys was applied to the various impact zones. The impact calculations for this section utilize marine mammal and sea turtle density estimates that have been derived from GulfCet II (1996-1998) surveys. The survey area is known as the Minerals Management Service Eastern Planning Area and may be divided into continental shelf and continental slope regions. The survey area of the shelf for GulfCet II is defined as 18.5 kilometers offshore to 100 meters deep between 88°10.0′West and 85°55.0′W and totals 12,326 km^2. The slope region is defined as waters 100 to 2,000 meters deep east of 88°10.0′W and north of 26°00.0'N and covers an area of 70,470 km^2 (Davis et al., 2000).

In order to provide better species conservation and protection, the species density estimate data were adjusted to reflect more realistic encounters of these animals in their natural environment and consider temporal and spatial variations and surface and submerged variations. Details on density adjustments are given in Appendix D.

By using conservative mathematic calculations, conservative density estimates can serve as a respectable management technique for take estimates. The densities are adjusted for the time the animals are submerged and are further adjusted by applying standard deviations to provide an approximately 99-percent confidence level. As an example, the density estimates for bottlenose

dolphins range from 0.06 to 0.15 animals/km^2 in GulfCet II aerial surveys of the shelf and slope. However, the final adjusted density used in take calculations is 0.81 animals/km^2."

Tables 4-10 and 4-11 provide cetacean and sea turtle densities on the Gulf of Mexico shelf.

Table 4-10. Cetacean Densities for Gulf of Mexico Shelf Region

Species	Individuals/ 100 km^2	Individuals/ km^2	Dive profile - % at surface	Adjusted density (Individuals/km^2)*
Dwarf/pygmy sperm whale	0.081	0.001	20	0.013
Bottlenose dolphin	14.798	0.148	30	0.810
Atlantic spotted dolphin	8.890	0.089	30	0.677
T. truncatus/S. frontalis	0.665	0.007	30	0.053
Totals	**24.4**	**0.245**		**1.553**

*Adjusted for undetected submerged animals to two standard deviations.

Table 4-11. Sea Turtle Densities for Gulf of Mexico Shelf Region

Species	Individuals/ 100 km^2	Individuals/ km^2	Dive profile - % at surface	Adjusted density (Individuals/km^2)*
Loggerhead	4.077	0.041	10	0.617
Kemp's ridley	0.097	0.001	10	0.038
Leatherback	0.327	0.003	10	0.081
Unidentified chelonid	0.340	0.003	10	0.073
Totals	**4.841**	**0.048**		**0.809**

*Adjusted for undetected submerged animals to two standard deviations.

Table 4-12 gives the estimated impact ranges for various explosive weights for summer and wintertime scenarios. The proposed test locations are >12 NM south of Santa Rosa Island and south of Cape San Blas Site D3-A in waters approximately 40 meters deep. SDB scenarios are for in-air detonations at heights of 1.5 meters (5 feet) and 7.6 meters (25 feet) at both locations. JASSM detonations were modeled for near surface (i.e., 1-foot depth) and below surface (>20-foot depth). To account for "double" events, the weights are doubled and the results used for the energy estimate (since energy is proportional to weight).

For peak pressure and positive impulse, the thresholds are applied to the maximum values received by an animal. This can be viewed as consistent with SEAWOLF and CHURCHILL to the extent that the multiple arrivals for a single explosive are treated as separate exposures over time. Since JASSM events may call for multiple explosions, the CHURCHILL approach had to be extended to cover multiple noise events at the same training site and for time frames up to six hours. For multiple exposures, accumulated energy over the entire training time is the natural extension for energy thresholds; this is consistent with the energy argument in CHURCHILL. For peak pressure and positive impulse, it is consistent with CHURCHILL to use the maximum values over all impulses received.

Table 4-12. Zones of Impact for Underwater Explosions (Mid-Depth Animal) for Marine Mammals and Sea Turtles Under the Proposed Action

Ordnance	NEW (TNT in lb)	Depth or Height of Explosion (m)	Ranges for 182 dB EFDL in 1/3 Octave Band (m)	Ranges for 23 psi (m)	Ranges for EFDL > 205 dB (m)	Ranges for 31 psi-ms (m)
Summer						
Single SDB	48	1.5	47	447	12	0
		7.6	48	447	12	0
Double SDB	96	1.5	65	550	16	0
		7.6	66	559	17	0
Single JASSM	300	0.3	520	770	170	75
		>6.1	2490	770	550	320
Winter						
Single SDB	48	1.5	47	471	12	0
		7.6	48	471	12	0
Double SDB	96	1.5	65	594	16	0
		7.6	66	594	16	0
Single JASSM	300	0.3	580	871	170	75
		>6.1	3250	871	590	320

EFDL = Energy Flux Density Level

Applying the 31 psi-ms, the 205 dB, and the dual 23 psi and 182 dB impact ranges in Table 4-12 to the estimated species densities of Tables 4-10 and 4-11, the number of animals potentially occurring within the zones of impact was estimated. Detailed results are presented in Appendix D. Where calculation totals result in fractions of an animal, a whole animal is defined as 0.5 or greater, and thus a take. Where less than 0.5 animals are affected, no take is assumed.

Noise Effects Summary for the Proposed Action

Analysis indicates that given the range of depth detonations at the barge target, non-lethal harassment and the onset of injury to cetaceans and sea turtles is likely from the Proposed Action (See Appendix D for more detail). The 1-foot and >20-feet represent the bounds of potential effects, though in reality some combination of depths would occur during actual testing. A more accurate estimate lies somewhere in between the upper and lower impact ranges. Wintertime testing would potentially result in a higher number of takes than summertime.

For the Proposed Action, one marine mammal has the potential to be killed or seriously injured by JASSM testing. Mitigations would be implemented by Eglin AFB and include visual monitoring by surface vessel and aircraft. This level of monitoring would result in an approximate effectiveness of 30 percent (NMFS, 2005). Therefore, with these mitigations in place, no mortality would occur to marine mammals. As many as two cetaceans are estimated to be exposed to Level A 205 dB noise. However, with mitigations in place, only one animal would be affected at Level A harassment. Level B noise would potentially affect as few as 31 or as many as 53 cetaceans depending on the season and depth. Eglin AFB would implement mitigations that include visual surveys to clear the area of protected species and therefore, with 30 percent effectiveness, Level B noise would affect between 22 and 37 individuals depending on the testing conditions.

No sea turtles would be exposed to lethal noise. Only one sea turtle would be potentially exposed to the 205 dB noise level. As few as 16 and as many as 27 sea turtles would be exposed

to Level B harassment. These numbers would be reduced through mitigations proposed by Eglin AFB and approved by the NMFS to as few as 11 and as many as 11 individuals.

In compliance with the ESA and Marine Mammal Protection Act, the Air Force initiated consultation for an incidental take authorization from National Oceanic and Atmospheric Administration (NOAA)/National Marine Fisheries Service (NMFS) in 2004. NMFS issued an Incidental Harassment Authorization (IHA) in July 2005 (see Appendix B) allowing for the authorization of the harassment of a small number of protected species incidental to conducting the PSW testing, provided mitigations and monitoring are conducted. The IHA does not allow for the injury or mortality of any marine mammals. The IHA is valid for one year. The Air Force and NMFS are currently developing a Letter of Authorization (LOA) that will cover the five-year PSW test plan and allow for the injury and mortality of a small number of protected species incidental to the PSW testing.

Impact Minimization Measures and Proposed Management Practices

The effectiveness of pre-test monitoring is expected to reduce the take estimates of protected species (provided in Section 4.3) by 30 percent (NMFS, 2005). The details of the monitoring are discussed in the PSW Mitigations for Protected Species. This document is provided in Appendix A with general information given in the following paragraphs.

Prior to the test, two trained observers aboard a helicopter, provided by the 46 OG/OGMTA, would survey the test area. Additionally, the lead scientist and experienced observers would survey the test area from a surface vessel. These methods are very effective in the detection of sea turtles and cetaceans. A site would be selected for the barge target that did not have any obvious weedlines or large *Sargassum* mats, features known to attract fish and sea turtles. In the event that any human safety concerns arise or protected species are sighted within the noise impact zones, the test would be postponed. The area to be surveyed would encompass the injury ZOI plus a buffer area (an area equal to twice the injury ZOI). The area to be surveyed for summer and winter scenarios are provided in Table 4-13.

Table 4-13. Survey Areas for Single SDB, Double SDB, and Single JASSM Test Events During Summer and Winter Shots

Ordnance	NEW (TNT in lb)	Survey Area
Summer		
Single SDB	48	0.0194 NM
Double SDB	96	0.0275 NM
Single JASSM	300	0.891 NM
Winter		
Single SDB	48	0.0194 NM
Double SDB	96	0.0259 NM
Single JASSM	300	0.956 NM

If a protected species were observed within this area, the test would be stopped or postponed until the area was clear of the animals. Testing would cease or be postponed if a protected species were detected in the surveyed area and subsequently could not be reacquired. The presence of definitive indicators of protective species (i.e., *Sargassum* rafts or jellyfish) and/or large schools of fish create immediate postponement events.

Avoidance of impacts to schools of cetaceans would most likely be realized through these measures since groups of dolphins are relatively easy to spot from the survey distances and with the methods and number of monitors that would be employed. Typically, solitary marine mammals such as dwarf/pygmy sperm whales and sea turtles, while more challenging to detect would also be afforded substantial protection through pre-test monitoring. Simultaneous ship and aerial surveys and multiple aircraft and vessels would increase the efficiency of pre-test monitoring. Execution of the test would not commence if a sea turtle or cetacean were sighted within the zone of influence. As a result, impacts to protected species would not be significant and an environmental impact statement is not required for the Proposed Action.

4.3.2 Alternative 1: Increased Intensity of Live JASSM Shots

As with the Proposed Action, noise would potentially affect fish, birds, marine mammals, and sea turtles.

Potential Impacts to Fish and Bird Species

Safe ranges for fish are slightly different under Alternative 1. A greater potential for injury or mortality to fish exists under this alternative although numbers cannot be estimated. Table 4-14 presents safe ranges for explosives and depth scenarios under this alternative. Impacts to bird species would increase under this alternative as a result of the increase in net explosive weight. Human activity and helicopter overflights around the barge target would presumably cause birds to leave the immediate area.

Table 4-14. Alternative 1 Safe Range Scenarios for Fish

NEW (TNT) in pounds (lbs)	Depth of Explosion	Range for 1 oz fish (m)	Range for 1 lb fish (m)	Range for 30 lb fish (m)
600	> 20 ft	769	558	370
	1 ft	406	285	160
300	> 20 ft	641	453	292
	1 ft	348	237	131
48	> 20 ft	396	262	157
	1 ft	271	146	78

Potential Impacts to Marine Mammals and Sea Turtles

For Alternative 1, the addition of a double-shot JASSM detonation was considered and is shown in Table 4-14 as 600 pounds of net explosive (TNT-equivalent). Table 4-15 lists all combinations of explosive for this alternative as modeled at two depth scenarios.

Table 4-15. Estimated Idealized Impact Ranges for Underwater Explosions (Mid-Depth Animal) for Marine Mammals and Sea Turtles Under Alternative 1

Ordnance	NEW (TNT in lb)	Depth or Height of Explosion (m)	Ranges for 182 dB EFDL in 1/3 Octave Band (m)	Ranges for 23 psi (m)	Ranges for EFDL > 205 dB (m)	Ranges for 31 psi-ms (m)
Summer						
Single SDB	48	1.5	47	447	12	0
		7.6	48	447	12	0
Double SDB	96	1.5	65	550	16	0
		7.6	66	550	17	0
Single JASSM	300	0.3	520	770	170	75
		>6.1	2490	770	550	320
Double JASSM	600	0.3	640	770	210	75
		>6.1	3740	770	890	320
Winter						
Single SDB	48	1.5	47	471	12	0
		7.6	48	471	12	0
Double SDB	96	1.5	65	594	16	0
		7.6	66	594	16	0
Single JASSM	300	0.3	580	871	170	75
		>6.1	3250	871	590	320
Double JASSM	600	0.3	760	871	210	75
		>6.1	5000	871	950	320

EFDL = Energy Flux Density Level
* Total NEW would equal 600; however, the Double JASSM is analyzed with consideration for single 300 pound shots fired within 5 seconds of one another.

Applying the 182 and 205 dB impact ranges in Table 4-15 to the species density tables, Tables 4-10 and 4-11, the number of animals potentially occurring within the Alternative 1 zones of impact was estimated. Detailed results are presented in Appendix D.

Noise Effects Summary for Alternative 1

Under Alternative 1, the increase in the number of JASSMs tested would potentially expose two marine mammals to lethal noise levels. The implementation of mitigations and their subsequent effectiveness would reduce this take to one individual. The potential exists for eight marine mammals to be affected by Level A (205 dB) noise. Mitigations would be implemented by Eglin AFB, which include visual monitoring by support platforms. The level of monitoring would result in an approximate effectiveness of 30 percent (NMFS, 2005). Therefore, with these mitigations in place, only six individuals would be affected. Finally, depending on the season of testing, as few as 92 and as many as 156 marine mammals would be exposed to noise at Level B harassment. Mitigations would reduce the level of takes to 65 and 109, respectively. Therefore for Alternative 1, consultation with the National Marine Fisheries Service would be required and a take statement would need to be issued prior to the conduct of this action. The overall number of animals impacted for this alternative is roughly twice that of the Proposed Action.

The potential exists for one sea turtle to be exposed to lethal noise levels under Alternative 1; mitigations would not reduce this take level to zero. This alternative would also result in exposure of four sea turtles to noise at Level A harassment; mitigations would effectively reduce one of these takes, resulting in exposures to three individuals. Finally, as few as 48 and as many

as 81 sea turtles would be affected by Level B harassment. Implementation of the proposed mitigations would reduce these numbers to 34 and 57, respectively. Based on this estimation, consultation with the National Marine Fisheries Service and a take statement would need to be issued prior to the conduct of this action. Under the ESA, a Section 7 consultation with the NOAA Office of Protected Resources would be required for potential impacts from Alternative 1.

4.3.3 No Action Alternative

The No Action Alternative would result in no noise impacts to Gulf of Mexico resources over existing baseline conditions.

4.4 BIOLOGICAL RESOURCES

Biological resources considered in this document as part of the affected environment include bottom habitats and species, and invertebrate species, seabirds and migratory birds, and protected species. Protected species include some species of birds, all sea turtles, and all marine mammals that could potentially occur within the region of influence. The aspects of the project that most interact with biological resources and habitats are:

- The barge and CONEX targets would potentially attract fish and birds. Floating structures, particularly unmanned, would potentially be used by birds as a resting place. During spring and fall migrations (April and August), the numbers of bird species is likely to increase. Fish, invertebrates, and sea turtles are known to congregate around moored or floating objects and structures. The longer the target is at the test location, the more fish it will attract.
- Blast noise and flying debris would potentially kill fish and birds at the target site. As discussed above, fish and birds would likely be attracted to the target site over a period of time. These animals would potentially be subjected to lethal blast impacts. More detail on the effects of noise and blast effects on biological resources is presented in Section 4.3, Noise.
- The mooring of the barge targets would disturb a small but insignificant area of sea floor. Some marine habitats have been designated as essential fish habitat (EFH) by the National Marine Fisheries Service and require consideration under the Magnuson-Stevens Fisheries Act. To alleviate any potential impacts to protected habitat, hardbottom habitats would be avoided. Hardbottom is rocky or coral outcroppings that, though scattered, do exist within or near the affected environment.
- Aggregations of the floating aquatic plant *Sargassum sp.* harbor a variety of marine life including protected species. *Sargassum* forms large drifting mats (sometimes miles long) and in the Gulf of Mexico provides practically the only near-surface habitat over large open waters. A variety of fish and invertebrate species inhabit *Sargassum* mats and large predatory fish (e.g., mahi) are consistently found near floating mats. Thus the National Marine Fisheries has determined that this aquatic plant constitutes an EFH.
- Debris can have negative impacts if ingested by marine animals, or an overall positive impact when providing suitable habitat for fish and invertebrates, as occurs with the

placement of artificial reefs. Plastics introduced into the marine environment are well documented to cause potential injury or death to marine mammals and sea turtles when ingested or through entanglement. As compared to the overall munitions and debris from EGTTR activities, the PSW Tests would contribute a very small amount of debris within this region. Mission avoidance of the Florida Middle Grounds provides the best assurance for habitat protection. Considering the above, no adverse effects to the Florida Middle Ground are anticipated.

- The incidental and/or intentional sinking of all or part of the barge targets could provide beneficial artificial reef habitat. A permit would need to be obtained from the USACE.

4.4.1 Proposed Action (Preferred Alternative)

The primary effect on biological resources would be from noise from bomb detonations. Consultations and permits would be required for potential impacts to protected marine mammals and sea turtles. More information is provided in Section 4.3, Noise.

4.4.2 Alternative 1: Increased Intensity of Live JASSM Shots

Impacts to biological resources would approximately double in terms of number of protected species affected. All other environmental effects would be approximately the same. Other operations would be the same. Hardbottom habitats would be avoided. Barge sinking would require an artificial reef permit from the USACE.

4.4.3 No Action Alternative

Under the No-Action alternative, there would be no environmental effects to biological resources of the Gulf of Mexico beyond existing activities occurring within the ROI.

4.5 RESTRICTED ACCESS/SOCIOECONOMICS

4.5.1 Proposed Action (Preferred Alternative)

Clearing the EGTTR of private and commercial boats under the overflight area would not be necessary due to the safety and known precision of both SDB and JASSM. During the mission under this test scenario, the affected area in the Gulf of Mexico around the targets would be cleared of all commercial and recreational boats. The cleared area would include a safety footprint approximately 4 miles in diameter around each target. The area would be cleared with the assistance of the Coast Guard and the Coast Guard Auxiliary and/or Navy and Air Force vessels. Clearing the target safety footprint would require the coordination of Coast Guard officials with 46 OG/OGMTA, 46th Operations Group, and would include public announcements. The Coast Guard typically posts the location and date of launches in the Notice to Mariners one week prior to launch activities. Each test event (launch of weapon) from the aircraft platforms would require a potential access restriction for up to four hours per test day.

In addition to the airspace and water restricted access issues, it is anticipated that issues of regulatory compliance must also be met with several agencies. The infrastructure of the barges or CONEX target are primarily regulated by the USACE under section 10 of the Rivers and

Harbors Act and are considered as a "floating island" (barges) within navigable waterways (33 CFR 322). This activity may be permitted as temporary structures (5 years) or permanent structures. Additionally, navigational safety lighting would be required on the target.

Each time a single shot is deployed, approximately 13 square miles of the Gulf of Mexico would be cleared for up to 4 hours per test event. Over the five-year plan, a significant impact to socioeconomic resources (commercial fishing, shipping, etc) resulting from the clearing is not anticipated from these short closures. Additionally, as major shipping routes will not be affected by the closures (see Figure 3-4, Shipping), delay or interruption of socioeconomic conditions is not expected. However, continuing extensive closures of this nature may cause public annoyance. Commercial and recreational fishermen would most likely go around the area. The closure would encompass a small area of the Gulf; the restricted area would represent less than one percent of W-151. Therefore, it is unlikely that the closure would require a vessel to return to port from limited fishing capability or require a charter fishing company to provide a refund to passengers. For this reason, the impact of restricted access under the preferred alternative yields this cumulative effect over five years.

4.5.2 Alternative 1: Increased Intensity of Live JASSM Shots

Clearing the EGTTR of private and commercial boats, except under the launch and impact areas of the weapons, will not normally be necessary due to the known safety and reliability of the JASSM. However, coordination with the Eglin Range Safety Office (AAC/SEU) will be required prior to any launch and following the development and submission of a flight profile by the 46 OG/OGMTA. Closure of the area immediately surrounding the target area would be required as described under the Proposed Action.

4.5.3 No Action Alternative

Under the No Action Alternative, the Precision Strike Weapons Test would not occur. No restricted access issues or impacts to socioeconomics would occur over and above those that occur under existing operational conditions.

4.6 AIRSPACE

4.6.1 Proposed Action (Preferred Alternative)

All parts of the EGTTR, when activated, are Warning Areas that restrict all public and commercial use of this airspace. In general, the level of military activity in areas over the Gulf is considered moderate. Flight avoidance procedures have been effective in reducing the potential for any civilian-military aircraft interactions.

PSW testing would require clearance of various areas of airspace and may cause rerouting or rescheduling of flights. The safety office would determine the length and timing of closures of the airspace once flight profiles could be filed by 46 OG/OGMTA. In advance of any testing, 46 OG/OGMTA may submit typical flight profiles to Range Safety for review. A Notice to Airmen would be issued to forewarn flight operations personnel of activities, hazards, and closures associated with PSW Tests. Significant disruption to airspace is not anticipated and

adverse impacts from this activity are not likely. The EGTTR PEA provides a full analysis of potential impacts to airspace (U.S. Air Force, 2003).

4.6.2 Alternative 1: Increased Intensity of Live JASSM Shots

Potential impacts would be the same as those described under the Proposed Action. Consequently, adverse impacts from this activity are not likely.

4.6.3 No Action Alternative

As the PSW Tests would not occur and there would be no impacts to airspace above existing conditions.

4.7 SAFETY AND OCCUPATIONAL HEALTH

4.7.1 Proposed Action (Preferred Alternative)

Through coordination with the 46 OG/OGMTA, Eglin's Range Safety Office would define footprints around target areas with an adequate margin of safety to protect the public health. As flight profiles have yet to be developed, it is impossible to determine the precise location and dimension of the safety footprints. However, the Eglin Range Safety Office has confirmed that at a minimum, safety footprints would be at least 2 NM in radius extending from each target location for each JASSM test event. This area (approximately 12.56 square miles [Figure 4-1]) would be cleared of any surface craft prior to each mission. At a minimum, four surface craft would be used to maintain the buffer and ensure that there is no breach of the safety buffer by public or private craft. Commercial and recreational watercraft would not be restricted from corridors beneath either the JASSM or SDB during captive carriage. All commercial and recreation watercraft would be restricted from the target impact area in order to be protected from health issues including the detonation and subsequent noise profile. The standards of 140 dBP (0.029 psi) and 115 dBP (0.002 psi) are used for human hearing protection requirements and annoyance to the public, respectively. Noise overpressure levels of 140 dBP (0.029 psi) would extend approximately 1 NM from the impact area, but not beyond the safety footprint. A NOTMAR would be required prior to the closure of the safety buffers around target locations.

In the event of a dud, the PSW test team would make every effort to recover the weapon from the sea floor. It should be noted that the JASSM is equipped with a system that renders a live weapon a dud if it does not detonate within 15 minutes after impact (U.S. Air Force, 2004). The capacitors lose their charge and the weapon cannot detonate. However, targets will be positioned in areas where dredge equipment, drilling equipment, or anchors are typically not used (U.S. Air Force, 2005). In the event that the weapon will need to be terminated, personnel in the E-9 turboprop aircraft will help locate boats along the route and will use that data to pick the best place possible to do so (U.S. Air Force, 2005).

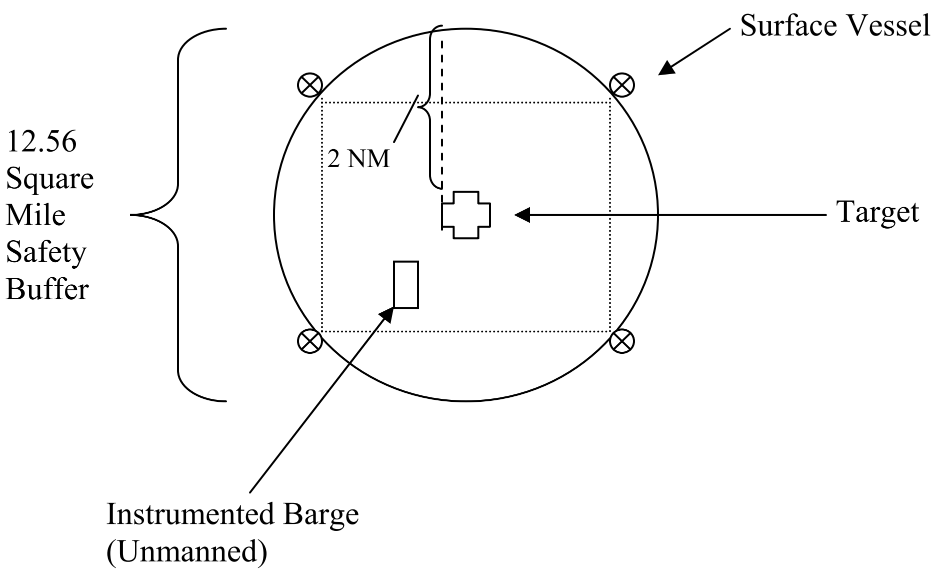

Figure 4-1. Safety Footprint Around Target Area

4.7.2 Alternative 1: Increased Intensity of Live JASSM Shots

Under Alternative 1, the additional JASSM live shots would not further extend safety footprints or potential impacts to safety and occupational health. Anticipated impacts are the same as those under the Proposed Action.

4.7.3 No Action Alternative

Under the No Action Alternative the PSW Test would not occur and there would be no impacts to safety and occupational health above existing baseline operations.

4.8 CULTURAL RESOURCES

4.8.1 Proposed Action (Preferred Alternative)

For the live tests, the JASSM and SDB would detonate at or near the water's surface. Depending on the extent of damage to the target, it may sink on its own, or it may be deemed necessary to sink it because it is unsafe/impractical to retrieve it. Both the JASSM and SDB inerts puncture their respective targets, with the warhead continuing through to land on the seafloor. These warheads may not be recovered. Both the warheads and the sunken targets could potentially impact submerged cultural resources.

Target areas were selected to avoid known shipwrecks. The Eglin target site is located over 11 miles from the closest known shipwreck, and the Cape San Blas target site is almost 8 miles from the nearest known shipwreck (see Figure 3-7). Because the sites are not located near any known shipwrecks, no impacts to cultural resources are anticipated and consultation with the SHPO will not be required. However, the SHPO will be notified of the activity through the Intergovernmental and Interagency Coordination of Environmental Planning process.

4.8.2 Alternative 1: Increased Intensity of Live JASSM Shots

Potential impacts would be the same as those described under the Proposed Action. Consequently, adverse impacts from this activity are not likely.

4.8.3 No Action Alternative

The activity would not occur; therefore, no impacts to cultural resources are anticipated over and above potential impacts occurring from baseline operations.

4.9 CUMULATIVE EFFECTS AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

4.9.1 Cumulative Effects

According to CEQ regulations, cumulative effects analysis in an EA should consider the potential environmental impacts resulting from "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions" (40 CFR 1508.7).

Definition of Cumulative Effects

Cumulative effects may occur when there is a relationship between a Proposed Action and other actions expected to occur in a similar location or during a similar time period. This relationship may or may not be obvious. Actions overlapping with or in close proximity to the Proposed Action can reasonably be expected to have more potential for cumulative effects on "shared resources" than actions that may be geographically separated. Similarly, actions that coincide temporally will tend to offer a higher potential for cumulative effects.

In this EA, an effort has been made to identify all actions on or near the action area that are being considered and are in the planning stage at this time. To the extent details regarding such actions exist and the actions have a potential to interact with the Proposed Action outlined in this EA, these actions are included in the cumulative analysis.

4.9.2 Past, Present, and Reasonably Foreseeable Actions

This EA applies a stepped approach to provide decision-makers with not only the cumulative effects of the Proposed and Alternative Actions, but also the incremental contribution of past, present, and reasonably foreseeable actions.

Past and Present Actions Relevant to the Proposed Action and Alternative

The EGTTR Programmatic Environmental Assessment evaluated many activities associated with the PSW Test. Inert and live detonations in the GOM, debris, chemical materials, restricted access, safety, and socioeconomics were evaluated and determined to have no significant impact on the environment. Live detonations with NEWs as large as those in the JASSM and SDB were not evaluated in the PEA. No other actions, either past or present, in or near the EGTTR

Precision Strike Weapons Test were found to be relevant to the Proposed Action or Alternatives (e.g., large developments or construction projects).

Reasonably Foreseeable Future Actions

Interviews with 46 OG/OGMTA have identified no reasonably foreseeable future developments relevant to the Proposed Action or Alternatives over the next five years.

4.9.3 Analysis of Cumulative Impacts

Use of the EGTTR for military testing and training is ongoing, and will continue into the future. Due to the short duration of each PSW test event, the temporary nature of potential impacts, and the insignificance of the longer term impacts (e.g., debris increase), cumulative impacts to the environment within the context of existing and potential future operations are not anticipated. No cumulative impacts have been identified.

4.9.4 Irreversible and Irretrievable Commitment of Resources

NEPA requires that environmental analysis includes identification of any irreversible and irretrievable commitments of resources that will be involved in the Proposed Action should it be implemented. Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource such as energy and minerals that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action, such as extinction of a threatened or endangered species or the disturbance of a cultural site.

Proposed and Alternative Actions

For the Proposed Action and Alternatives, most resource commitments are neither irreversible nor irretrievable. Most environmental consequences such as restricted access and chemical deposition in the GOM from the weapons are short-term and temporary or longer lasting but negligible (e.g., debris increases).

It can be assumed that some marine life, including fish and sea birds, may be attracted to the barge/target depending on the length of time the structure is in the GOM. As a result of this detonation, some number of these fish and birds may be killed as a result of the detonation of the PSWs. Impacts to threatened and endangered species are not anticipated due to surveying and monitoring efforts developed under the proposed management actions. Additionally, there will be no significant impact to any species population, essential fish habitat, or commercial fishery. As such, this action is not expected to significantly decrease the availability of these resources.

5. PLANS, PERMITS, AND MANAGEMENT ACTIONS

The following is a list of the plans, permits, and management actions associated with the Proposed Action. The need for these requirements were identified by the environmental analysis process in this environmental assessment and were developed through cooperation between the proponent and interested parties involved in the Proposed Action and Alternative. These requirements are therefore to be considered as part of the Proposed Action and would be implemented through the Proposed Action's initiation. The proponent is responsible for adherence to and coordination with the listed entities to complete the plans, permits, and management actions.

PLANS

A flight plan would be established previous to each test event. The 46 OG/OGMTA would review the established flight plan with Eglin's Range Safety office so that precise safety buffers and boundaries may be set.

PERMITS

In compliance with the ESA and Marine Mammal Protection Act, the Air Force initiated consultation for an incidental take authorization from National Oceanic and Atmospheric Administration (NOAA)/National Marine Fisheries Service (NMFS) in 2004. NMFS issued an Incidental Harassment Authorization (IHA) in July 2005 (See Appendix B) allowing for the authorization of the harassment of a small number of protected species incidental to conducting the PSW testing, provided mitigations and monitoring are conducted. The IHA, which is valid for one year, does not allow for the injury or mortality of any marine mammals. The Air Force and NMFS are currently developing a Letter of Authorization (LOA) that will cover the five-year PSW test plan and allow for the injury and mortality of a small number of protected species incidental to the PSW testing.

A permit to sink the target, if necessary, may be required. Coordination with the U.S. Army Corps of Engineers and the USCG Marine Safety Office would determine the requirement and protocol for sinking the target.

MANAGEMENT ACTIONS

The proponent is responsible for the implementation of the following management actions, as identified in the IHA (Appendix B) and in Appendix A, Mitigations for Protected Species.

Biological Resources

- Trained observers would monitor the target area for protected species prior to weapons launch. The mitigations for protected species, provided in Appendix A provide detailed information on activities to mitigate the impact of JASSM and SDB testing. A general overview is provided in the following paragraphs.

Monitoring would occur from both support helicopter assets and surface vessels. The 46 OG/OGMTA would provide the aerial platform. Additionally, other passive monitoring techniques would be considered. Vessel-based observations would be conducted by the lead scientist and an experienced observer. Shipboard monitoring would begin five hours prior to testing or at daybreak. Two experienced observers would conduct a pre-test aerial survey, commenced two hours prior to the test event. Approximately one to 1.5 hours prior to launch, ship and aerial platforms would leave the area and remain outside the safety zone (over 2 NM from impact for JASSM tests and 5 to 10 NM for SDB tests). The shipboard monitoring team would continue searching the buffer zone for protected species.

The mission would cease or be postponed if:

- A protected marine mammal or sea turtle species should be found within 1.75 NM of the target. The delay would continue until the protected species was confirmed to be outside of the ZOI.
- Any marine mammal or sea turtle is detected in the buffer zone and subsequently cannot be reacquired. The mission would continue when the last verified location of the animal was outside of the ZOI and the animal was moving away from the mission area.
- Definitive indicators of protective species are observed within the ZOI. The delay would continue until the *Sargassum* rafts or large schools of jellyfish were confirmed to be outside of the ZOI.
- Large schools of fish are observed within the ZOI. The delay would continue until the large fish schools were confirmed to be outside the ZOI.

Monitoring would resume immediately following each test as the test area would be surveyed for any animals killed or injured during the test. If practicable, observers would recover and examine any dead animals. Any observed dead or injured marine mammal or sea turtle would be reported to the appropriate stranding network coordinator. The total area to be monitored is 9.62 NM^2. Post-mission monitoring would end two hours after the test event.

- The PSW mission team would make every effort to recover surface debris from the target or the weapons following test activities. Every possible attempt that is deemed safe would be made to collect debris. In the event of a dud weapon, the mission team would make every practical and possible attempt to recover the dud.

Restricted Access and Socioeconomics

- Since there is a potential to sink targets, all targets must be placed so that there is at least 11 fathoms (66 feet) of water from the highest point on the sunken wreck to the surface.

- All closures in the Gulf will be coordinated with Eglin's Range Safety Office.

Safety and Occupational Health

- No test personnel would be allowed within the 12.56 NM^2 safety footprint from the time of weapon launch until weapon termination. This safety footprint would be closed off from public Gulf users for approximately four hours per test event.

- 46 OG/OGMTA would work closely with Eglin's Public Affairs Office to alert local communities prior to the test. A Notice to Airmen (NOTAM) and NOTMAR would be issued approximately one week before the test.

- Once developed, flight profiles would be reviewed with the Range Safety office. Range Safety would then develop precise safety footprints and any additional safety measures previous to each test event.

- The 46 OG/OGMTA would brief the test to the Range Activity Status Reporting Committee prior to test initiation.

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APPENDIX A

MITIGATIONS FOR PROTECTED SPECIES

MITIGATIONS FOR PROTECTED SPECIES

A.1 INTRODUCTION

Mitigations are measures taken to lessen or eliminate the impacts of an action. As defined in Council on Environmental Quality (CEQ) Regulations (40 CFR §1508.20), mitigation includes:

- Avoiding the impact altogether by not taking a certain action or part of an action.
- Minimizing impacts by limiting the degree of magnitude of the action and its implementation.
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
- Reducing or eliminating the impact over time through preservation and maintenance operations during the life of the action.
- Compensating for the impact by replacing or providing substitute resources or environments.

Mitigations may include any supplemental activities that are designed, proposed, and exercised to help reduce or eliminate the potential impacts (i.e., incidental harassment takes) to the marine resources. The Air Force recognizes the importance of such "in-place" mitigations and is aware that the National Marine Fisheries Service (NMFS) recommends an approved mitigation plan for protected species that outlines the scope and effectiveness of the proposed activity's mitigations.

A.2 IMPACT MINIMIZATION MEASURES AND PROPOSED MANAGEMENT PRACTICES

Eglin has agreed to survey the Zone of Influence (ZOI) and a buffer zone, which is twice the size of the ZOI. The 46th Test Wing Precision Strike Branch (46 OG/OGMTA) will provide all funding for mitigations associated with the PSW tests. Prior to the mission, trained observers aboard a helicopter or small airplane with proper surveying capabilities would survey (visually monitor) these zones, a very effective method for detecting sea turtles and cetaceans. The area to be surveyed would extend outward in every direction from the target. In addition, trained observers aboard surface support vessels would conduct ship-based monitoring for protected species (all marine mammals and sea turtles). The helicopter or plane would fly approximately 500 feet above the sea surface to allow observers to scan a large distance.

Weather that supports the ability to sight small marine life (e.g., sea turtles) is required to mitigate the test site effectively (U.S. Navy, 1998). Wind, visibility, and surface conditions of the Gulf of Mexico are the most critical factors affecting mitigation operations. Higher winds typically increase wave height and create "white cap" conditions, both of which limit an observer's ability to locate surfacing marine mammals and sea turtles. PSW missions would be delayed if the sea state were greater than 3.5 of Table A-1 below. This would maximize detection of marine mammals and sea turtles.

Table A-1. Pierson-Moskowitz Sea Spectrum - Sea State Scale for Marine Mammal and Sea Turtle Observation

Wind Speed (Kts)	Sea State	Significant Wave (Ft)	Significant Range of Periods (Sec)	Average Period (Sec)	Average Length of Waves (Ft)	Wind Speed (Kts)
3	0	<.5	<.5 – 1	0.5	1.5	3
4	0	<.5	.5 – 1	1	2	4
5	1	0.5	1 - 2.5	1.5	9.5	5
7	1	1	1 - 3.5	2	13	7
8	1	1	1 – 4	2	16	8
9	2	1.5	1.5 – 4	2.5	20	9
10	2	2	1.5 – 5	3	26	10
11	2.5	2.5	1.5 - 5.5	3	33	11
13	2.5	3	2 – 6	3.5	39.5	13
14	3	3.5	2 - 6.5	3.5	46	14
15	3	4	2 – 7	4	52.5	15
16	3.5	4.5	2.5 – 7	4	59	16
17	3.5	5	2.5 - 7.5	4.5	65.5	17
18	4	6	2.5 - 8.5	5	79	18
19	4	7	3 – 9	5	92	19
20	4	7.5	3 - 9.5	5.5	99	20
21	5	8	3 – 10	5.5	105	21

Ft = Feet; Kts = Knots; Sec = Seconds

Visibility is also a critical factor for flight safety issues. A minimum ceiling of 305 meters (1000 feet) and visibility of 5.6 kilometers (3 NM) is required to support mitigation and safety-of-flight concerns (U.S. Navy, 2001).

Aerial Survey/Monitoring Team

The proponent has agreed to complete an aerial survey before each mission and adequately train personnel to conduct aerial surveys for protected species. The aerial survey/monitoring team would consist of two observers. Aircraft provide preferable viewing platforms for detection of protected marine species. Each aerial observer should be experienced in marine mammal and sea turtle surveying and be familiar with species that may occur in the area. Each aircraft would have a data recorder who would be responsible for relaying the location, the species if possible, the direction of movement, and the number of animals sighted. The aerial monitoring team would also identify large schools of fish, jellyfish aggregations, and any large accumulation of *Sargassum* that could potentially drift into the ZOI. Standard line transect aerial surveying methods would be used. Aerial observers are expected to have adequate sighting conditions at sunrise within the weather limitation noted previously. Observed marine mammals and sea turtles would be identified to the species or the lowest possible taxonomic level and the relative position recorded. Mission activity would occur no earlier than two hours after sunrise and no later than two hours prior to sunset to ensure adequate daylight and pre- and post-mission monitoring.

Shipboard Monitoring Team

The proponent has agreed to conduct shipboard monitoring to reduce impacts to protected species. The monitoring would be staged from the highest point possible on a mission ship.

Observers would be familiar with the marine life of the area. The observer on the vessel must be equipped with optical equipment with sufficient magnification, which should allow the observer to sight surfacing mammals and/or sea turtles and provide overlapping coverage from the aerial team. A team leader would be responsible for reporting sighting locations, which would be based on bearing and distance.

The aerial and shipboard monitoring teams would have proper lines of communication to avoid communication deficiencies (Figure A-1). The observers from the aerial team and operations vessel would have direct communication with the lead scientist aboard the operations vessel. The lead scientist would be a qualified Marine Biologist familiar with marine surveys. The lead scientist would review the range conditions and recommend a Go/No-Go decision to the test director. The test director would make the final Go/No-Go decision.

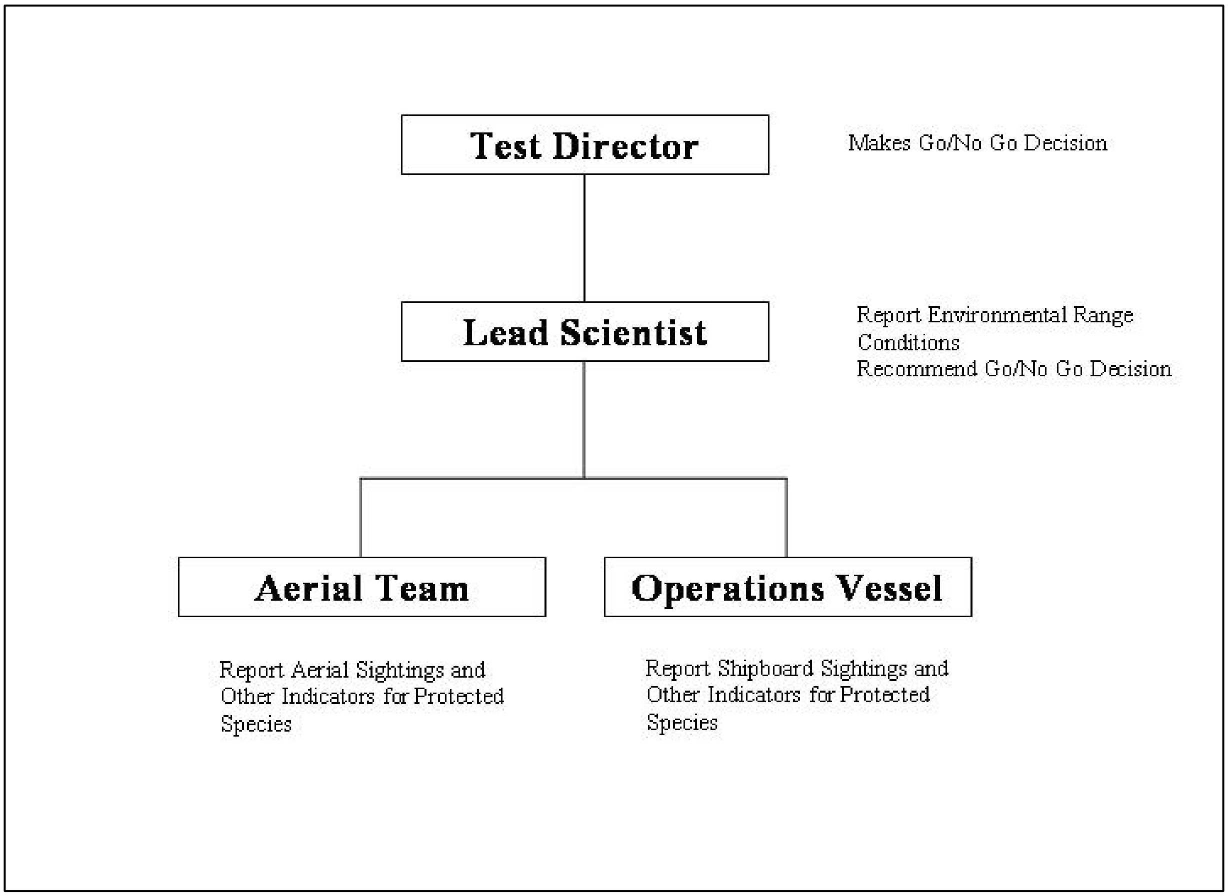

Figure A-1. PSW Lines of Communication for Go/No-Go Decision

Mitigation Procedures Plan

All zones (injury ZOI and buffer zones) are monitored. Precision Strike Weapons mitigations would be regulated by Air Force safety parameters (Monteith and Nowers, 2004). Although unexpected, any mission may be delayed or aborted due to technical reasons, which can last for several minutes up to a few hours. Actual delay times depend on the platforms (aircraft) supporting the test, test assets, and range time. Should a technical delay occur, all mitigation procedures would continue and remain in place until either the test took place or was canceled.

The ZOI and buffer zone around Joint Air-to-Surface Standoff Missile (JASSM) missions would be effectively monitored by shipboard observers from the highest point (flybridge) of the vessel. Vessels would be positioned as close to the safety zone as allowed without infringing on the flight corridor. A small diameter bomb (SDB) has many mission profiles and does not have a flight termination system; therefore, the safety buffer may be quite large (5 to 10 NM). Mitigations may be reduced for SDB missions due to mandatory safety buffers that limit the time and type of mitigations. Even though mitigations may be limited for SDB missions, all detonations are above the water surface (5 to 25 feet above the surface) and of much smaller net explosive weight than JASSM. Table A-2 describes safety zones and clearance times for JASSM and SDB missions.

Table A-2. JASSM and SDB Safety Zones and Clearance Times

	Flight Time	**Safety Clearance Time for Vessels before *Launch***	**Safety Clearance Time for Aircraft before *Launch***	**Total Time of Vessel Safety Clearance before *Detonation***	**Total Time of Aircraft Safety Clearance before *Detonation***	**Safety Area**
JASSM	:30 – 1 hr	:30	:15	1:30	1:15	2 NM
SDB	:20	:60	:30	1:20	:50	5-10 NM

Stepwise mitigation procedures for PSW missions are outlined below.

Pre-mission Monitoring: The purposes of pre-mission monitoring are to (1) evaluate the test site for environmental suitability of the mission and (2) verify that the ZOI is free of visually detectable marine mammals, sea turtles, large schools of fish, large flocks of birds, large *Sargassum* mats, and large concentrations of jellyfish (both are possible indicators of turtle presence). On the morning of the test, the lead scientist would confirm that the test sites could still support the mission and that the weather was adequate to support mitigation.

(a) Five Hours Prior to Launch

Approximately five hours prior to the launch, or at daybreak, the appropriate vessel(s) would be on-site in the primary test site near the location of the earliest planned mission point. Observers onboard the vessel would assess the suitability of the test site, based on visual observation of marine mammals and sea turtles, the presence of large *Sargassum* mats, and overall environmental conditions (visibility, sea state, etc.). This information would be relayed to the lead scientist.

(b) Two Hours Prior to Launch

Two hours prior to the launch, aerial monitoring would commence within the test site to evaluate the test site for environmental suitability. Evaluation of the entire test site would take approximately 1 to 1.5 hours. Shipboard observers would monitor the ZOI and buffer zone, and the lead scientist would enter all marine mammals and sea turtle sightings, including the time of sighting and the direction of travel, into a marine animal tracking and sighting database. The aerial monitoring team would begin monitoring the ZOI and buffer zone around the target area. The shipboard monitoring team would combine with the aerial team to monitor the area immediately around the mission area including both the ZOI and buffer zone. The shipboard monitoring teams would begin to migrate to the edge of the safety zone at approximately 1 hour before launch.

(c) One to 1.5 Hours Prior to Launch

Aerial and shipboard viewers would be instructed to leave the area and remain outside the safety area (over 2 NM from impact for JASSM and 5 to 10 NM for SDB). The aerial team would report all marine animals spotted and the directions of travel to the lead scientist onboard the vessel. The shipboard monitoring team would continue searching the buffer zone for protected species.

(d) Fifteen Minutes Prior to Launch and Go/No-Go Decision Process

Visual monitoring from surface vessels outside the safety zone would continue to document any missed animals that may have gone undetected during the past two hours and track animals moving in the direction of the impact area. The lead scientist would plot and record sightings and bearing for all marine animals detected. This would depict animal sightings relative to the mission area. The lead scientist would have the authority to declare the range fouled and recommend a hold until monitoring indicates that the ZOI was and would remain clear of detectable animals.

The mission would be postponed if:

1. Any marine mammal or sea turtle were visually detected within the ZOI. The delay would continue until the marine mammal or sea turtle that caused the postponement was confirmed to be outside of the ZOI due to the animal swimming out of the range.
2. Any marine mammal or sea turtle was detected in the buffer zone and subsequently could not be reacquired. The mission would not continue until the last verified location was outside of the ZOI and the animal was moving away from the mission area.
3. Large *Sargassum* rafts or large concentrations of jellyfish were observed within the ZOI. The delay would continue until the *Sargassum* rafts or jellyfish that caused the postponement were confirmed to be outside of the ZOI either due to the current and/or wind moving them out of the mission area.
4. Large schools of fish were observed in the water within the ZOI. The delay would continue until the large fish schools were confirmed to be outside the ZOI.

In the event of a postponement, pre-mission monitoring would continue as long as weather and daylight hours allow.

(e) Launch to Impact

Visual monitoring from vessels would continue to survey the ZOI and surrounding buffer zone and track animals moving in the direction of the impact area. The lead scientist would continue to plot and record sightings and bearing for all marine animals detected. This would depict animal sightings relative to the impact area.

If a live warhead fails to explode, the weapon is rendered a dud after 15 minutes. The feasibility and practicality of recovering the warhead would be evaluated on a case-by-case basis. If at all feasible, the warhead would be recovered.

Post-mission monitoring: Post-mission monitoring is designed to determine the effectiveness of pre-mission mitigation by reporting any sightings of dead or injured marine mammals or sea turtles. Post-detonation monitoring via shipboard surveyors would commence immediately following each detonation. The vessels would move into the ZOI from outside the safety zone and continue monitoring for at least two hours, concentrating on the area down current of the test site.

Marine mammals or sea turtles killed by an explosion would likely suffer lung rupture, which would cause them to float to the surface immediately due to air in the blood stream. Animals that were not killed instantly but were mortally wounded would likely resurface within a few days, though this would depend on the size and type of animal, fat stores, depth, and water temperature (U.S. Navy, 2001). The monitoring team would attempt to document any marine mammals or turtles that were killed or injured as a result of the test and, if practicable, recover and examine any dead animals. The species, number, location, and behavior of any animals observed would be documented and reported to the lead scientist.

The NMFS maintains stranding networks along coasts to collect and circulate information about marine mammal and sea turtle strandings. Local coordinators report stranding data to state and regional coordinators. Any observed dead or injured marine mammal or sea turtle would be reported to the appropriate coordinator.

A.3 SUMMARY OF MITIGATIONS FOR PROTECTED SPECIES

The test would be postponed if any human safety concerns arise, protected species were sighted within the ZOI, any protected species were detected in the buffer zone and subsequently could not be reacquired, or a protected species was moving into the ZOI from the buffer zone. PSW testing would be delayed if definitive indicators of protective species (i.e., large *Sargassum* mats) were present. The delay would continue until the marine mammal, sea turtle, and/or indicators that caused the postponement were confirmed to be outside of the ZOI due to the animal swimming out of the range.

Avoidance of impacts to schools of cetaceans would most likely be realized through these measures since groups of dolphins would be relatively easy to spot with the survey distances and methods that would be employed. Typically solitary marine mammals such as dwarf/pygmy sperm whales and sea turtles, while more challenging to detect, would also be afforded substantial protection through pre-test monitoring.

The safety vessels would conduct post-mission monitoring for two hours after each mission. The monitoring team would attempt to document any marine mammals or turtles that were killed or injured as a result of the test and, if practicable, recover and examine any dead animals.

During the anchoring and placement of the barge target, hardbottom habitats and artificial reefs would be avoided to alleviate any potential impacts to protected habitat. The PSW mission team would make every effort that was deemed safe to recover surface debris from the target or the weapons following test activities.

APPENDIX B

AGENCY COORDINATION

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RE: Department of the Air Force – Draft Environmental Assessment for Eglin Gulf Test and Training Range (EGTTR) Precision Strike Weapons (PSW) Test, 5-Year Plan – Eastern Gulf of Mexico – of Interest to the State of Florida.
SAI # FL200401135081C

Dear Ms. Vanta:

The Florida State Clearinghouse, pursuant to Presidential Executive Order 12372, Gubernatorial Executive Order 95-359, the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended, and the National Environmental Policy Act, 42 U.S.C. §§ 4321, 4331-4335, 4341-4347, as amended, has coordinated a review of the referenced Draft Environmental Assessment.

Based on the information contained in the subject document and the comments provided by our reviewing agencies, the state has determined that the proposed project is consistent with the Florida Coastal Management Program.

Thank you for the opportunity to review the project. Should you have any questions regarding this letter, please contact Mr. Daniel Lawson at (850) 245-2174.

Yours sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/dl

Enclosures

"More Protection, Less Process"

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My Florida

Florida
Department of Environmental Protection

"More Protection, Less Process"

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Project Information	
Project:	FL200401135081C
Comments Due:	February 12, 2004
Letter Due:	March 13, 2004
Description:	DEPARTMENT OF THE AIR FORCE - DRAFT ENVIRONMENTAL ASSESSMENT FOR EGLIN GULF TEST AND TRAINING RANGE (EGTTR) PRECISION STRIKE WEAPONS (PSW) TEST, 5-YEAR PLAN - EASTERN GULF OF MEXICO - OF INTEREST TO THE STATE OF FLORIDA.
Keywords:	USAF-EGLIN GULF TEST AND TRAINING RANGE WEAPONS TEST-GULF OF MEXICO
CFDA #:	12.200

Agency Comments:
ENVIRONMENTAL POLICY UNIT - OFFICE OF POLICY AND BUDGET, ENVIRONMENTAL POLICY UNIT
NO COMMENT
FISH and WILDLIFE COMMISSION - FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
No Comment
STATE - FLORIDA DEPARTMENT OF STATE
No Comment
ENVIRONMENTAL PROTECTION - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
No Comments

For more information please contact the Clearinghouse Office at:

AGENCY CONTACT AND COORDINATOR (SCH)
3900 COMMONWEALTH BOULEVARD MS-47
TALLAHASSEE, FLORIDA 32399-3000
TELEPHONE: (850) 245-2161
FAX: (850) 245-2190

Visit the Clearinghouse Home Page to query other projects.

02/24/2004 10:16 8502456437 BHP PAGE 02/02

COUNTY: ALL
SAI- USAF-EG
2004- 272

DATE: 1/13/2004
COMMENTS DUE DATE: 2/12/2004
CLEARANCE DUE DATE: 3/13/2004
SAI#: FL200401135081C

MESSAGE:

STATE AGENCIES	WATER MNGMNT. DISTRICTS	OPB POLICY UNIT	RPCS & LOC GOVS
ENVIRONMENTAL PROTECTION		ENVIRONMENTAL POLICY UNIT	
FISH and WILDLIFE COMMISSION			
X STATE			

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

_ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.

X Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.

_ Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.

_ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

Project Description:

DEPARTMENT OF THE AIR FORCE - DRAFT ENVIRONMENTAL ASSESSMENT FOR EGLIN GULF TEST AND TRAINING RANGE (EGTTR) PRECISION STRIKE WEAPONS (PSW) TEST, 5-YEAR PLAN - EASTERN GULF OF MEXICO - OF INTEREST TO THE STATE OF FLORIDA.

To: Florida State Clearinghouse

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TALLAHASSEE, FLORIDA 32399-3000
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EO. 12372/NEPA

☑ No Comment
☐ Comment Attached
☐ Not Applicable

Federal Consistency

☑ No Comment/Consistent
☐ Consistent/Comments Attached
☐ Inconsistent/Comments Attached
☐ Not Applicable

From:

Division/Bureau: Division of Historical Resources, Bureau of Historic Preservation
Reviewer: S. Edwards Laura A. Kammerer, Supervisor
Date: 1-15-04 1-15-2004
NHPA

04 JAN 14 PM 4: 10
BUREAU OF HISTORIC PRESERVATION
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COUNTY: ALL

DATE: 1/13/2004
COMMENTS DUE DATE: 2/12/2004
CLEARANCE DUE DATE: 3/13/2004
SAI#: FL200401135081C

MESSAGE:

STATE AGENCIES	WATER MNGMNT. DISTRICTS	OPB POLICY UNIT	RPCS & LOC GOVS
ENVIRONMENTAL PROTECTION		X ENVIRONMENTAL POLICY UNIT	
FISH and WILDLIFE COMMISSION			
STATE			

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DEPARTMENT OF THE AIR FORCE - DRAFT ENVIRONMENTAL ASSESSMENT FOR EGLIN GULF TEST AND TRAINING RANGE (EGTTR) PRECISION STRIKE WEAPONS (PSW) TEST, 5-YEAR PLAN - EASTERN GULF OF MEXICO - OF INTEREST TO THE STATE OF FLORIDA.

To: Florida State Clearinghouse

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EO. 12372/NEPA

- [x] No Comment
- [ ] Comment Attached
- [ ] Not Applicable

Federal Consistency

- [ ] No Comment/Consistent
- [ ] Consistent/Comments Attached
- [ ] Inconsistent/Comments Attached
- [ ] Not Applicable

From:
Division/Bureau: DEP Env. Policy
Reviewer: M Dannen
Date: 3/1/04

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JAN 14 2004

Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency: United States Department of Defense
Department of the Air Force

Activity: Eglin Gulf Test and Training Range, Precision Strike Weapons (PSW) Test (5-Year Plan)[Consultation No. F/SER/2004/00223]

Consultation Conducted By: National Marine Fisheries Service, Southeast Regional Office

Date Issued: ____________________

Approved By: ____________________
Roy Crabtree, Ph.D., Regional Administrator

This document constitutes the biological opinion of NOAA's National Marine Fisheries Service (NMFS) based on our review of Precision Strike Weapons (PSW) tests by the Department of Defense (DoD), Department of the Air Force (Air Force) proposed to occur in Warning Area 151 in the Eglin Gulf Test and Training Range (EGTTR). The EGTTR is managed by the DoD, Eglin Air Force Base, Florida. This opinion has been prepared in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1536 (a)(2), see also 50 CFR 402).

This biological opinion is based on information provided in the biological assessment for the EGTTR PSW Tests; published and unpublished scientific information on the biology and ecology of threatened and endangered species of cetaceans, sea turtles, and fish; and other sources of information.

Abstract

To comply with the requirements of the Endangered Species Act of 1973, NMFS has prepared a biological opinion (opinion) on the effects of the action proposed by the Department of Defense. Activities associated with the PSW tests within the EGTTR will result in the introduction of explosions, falling objects, marine debris, and contaminants into the marine environment. The area of EGTTR under consideration in the opinion includes portions of the northeastern Gulf of Mexico (GOM) off the coast of the Florida Panhandle.

Thirteen endangered and threatened species under NMFS= jurisdiction potentially occur in the GOM. The effects of the proposed action were analyzed for five species that have been determined to occur within the action area and may potentially be affected. The evidence

available for the assessment of the effects of sound and pressure waves associated with the proposed action on listed marine species is limited to information on the physics of sound and pressure wave propagation in the ocean environment and current knowledge of these effects on marine mammals and sea turtles. NMFS reviewed the proposed action for possible effects on the following species: leatherback (*Dermochelys coriacea*), Kemp=s ridley (*Lepidochelys kempii*), loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and hawksbill (*Eretmochelys imbricata*) sea turtles.

Based on published and unpublished studies, loud noises may result in harm or disruption of important behaviors (e.g., hearing impairment or disruption of feeding, breeding, or sheltering) in sea turtles. Any behavioral responses causing adverse effects to individuals, reproduction, recruitment, feeding, or injury due to PSW testing has the potential to result in negative impacts to these populations. The effects of shock waves have been determined to be the dominant effect on listed sea turtle species. Although some behavioral disturbance is possible, any noise will be of very short duration and the potentially harmful shock waves from explosions are considered to be the main effect of concern. NMFS believes that when mission activities are conducted above or in habitats where sea turtles may be found, precautionary measures should be taken to reduce the likelihood of any harm to individuals or populations (USFWS and NMFS 1998). Establishment and monitoring of impact zones will minimize the risks associated with the proposed action; however, some unavoidable adverse effects to sea turtles are expected to result from exploding ordnance and direct physical impacts from PSW testing in the EGTTR.

For the reasons detailed in this opinion and its associated Reasonable and Prudent Measures, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of any endangered or threatened species. No critical habitat is present for any of the above-listed species present in the action area.

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Consultation Background

Environmental concerns associated with underwater noise impacts of the 105 mm live round resulted in the suspension of the air-to-surface (A/S) Gunnery test and training activity (105 mm, 40 mm, and 25 mm) in January 1997. On August 4, 1997, NMFS issued an informal consultation that permitted a short-term resumption of limited daytime testing of the A/S Gunnery live rounds through December 1, 1997. Although only one test mission was conducted during that time frame, three additional missions were conducted in 1998. On April 9, 1998, a biological assessment was submitted to initiate a section 7 consultation in order to resume daytime A/S Gunnery test missions in the Gulf. NMFS issued a formal biological opinion on December 17, 1998, which concluded the actions were not likely to jeopardize the continued existence of five listed sea turtle species in the GOM, and issued an incidental take statement for sea turtles to minimize adverse effects resulting from that action. On February 18, 2003, Eglin reinitiated formal section 7 consultation on EGTTR missions expected to occur indefinitely into the future. NMFS issued a biological opinion that concluded the activities were not likely to jeopardize the continued existence of sea turtle species in the GOM, and issued an incidental take statement for sea turtles (NMFS 2004a). That biological opinion covered only those mission activities that are expected to occur on a regular basis over time, but did not cover unpredictable actions over shorter periods of time, such as new weapons testing and special training exercises in the EGTTR that could neither be predicted nor expected to occur regularly. These new actions, such as the proposed action, require a separate consultation under the ESA.

February 5, 2004: A letter dated February 13, 2003, was received by the NMFS from the DoD, Eglin Air Force Base, requesting interagency consultation under the ESA on the EGTTR PSW.

June 4, 2004: NMFS requested calculations be performed to predict the 176 dB re 1 ΦPa (energy flux density) zone of impact from the Joint Air-to-Surface Stand-off Missile (JASSM) and small-diameter bomb (SDB) to estimate the range where behavioral disturbance to sea turtles occurs.

June 7, 2004: NMFS requested additional information on whether explosives would be required to sink unrecoverable targets.

June 8, 2004: NMFS requested additional information on the breakdown of tests for each type of PSW test.

June 21, 2004: Eglin responded to requests for additional information regarding the proposed action.

August 4, 2004: NMFS provided a draft copy of the biological opinion to Eglin AFB for review regarding accuracy and ability to implement the reasonable and prudent measures. Eglin requested that consultation be temporarily suspended while the proposed mitigation plan was reconsidered due to logistical considerations of the proposed action.

October 6, 2004: Eglin provided NMFS with a revised mitigation plan for the proposed PSW tests and comments on the draft biological opinion.

November 29, 2004: A tele-conference call was held to discuss the new mitigation measures, the effectiveness of the mitigations, the effects of aerial versus underwater explosions resulting from the different PSW tests, and the potential take level resulting from the proposed action. NMFS requested additional information clarifying the number of each type of test, the zones of impact in air and water, and estimates of mitigation effectiveness and effects to sea turtles.

December 3, 2004: Eglin provided additional information on zones of impact, mitigation effectiveness, and effects to sea turtles as requested on November 29, 2004.

1.0. Description of Proposed Action

The Air Force, in cooperation with the 46th Test Wing Precision Strike Division, proposes to conduct a series of PSW test missions during the next five years utilizing areas within the EGTTR (Figure 1). The weapons to be tested are the JASSM, and the SDB. The Eglin Military Complex is a DoD Major Range Test Facility Base that exists to support the DoD mission actions. The primary function of the EGTTR is to support research, development, test, and evaluation of conventional weapons and electronic systems. Its secondary function is to support training of operational units. The range is composed of four components:

- Test Areas/Sites
- Interstitial Areas (areas beyond and between the test areas)
- The Eglin Gulf Test and Training Range
- Airspace (over land and water)

Eglin controls airspace overlying approximately 86,000 square miles (mi^2) within the GOM (Figure 1). The EGTTR airspace is controlled by the Federal Aviation Administration (FAA), but scheduled by Eglin AFB. This airspace includes Warning Areas (W-151, W-168, and W-470), as well as Eglin Water Test Areas (EWTA-1 through EWTA-6). The EGTTR is further described as the airspace over the GOM beyond 3 NM from shore that is controlled by Eglin AFB. The proposed two action areas for the PSW tests are located approximately 15-24 NM from shore in approximately 45.7 m of water (25 fathoms), within W-151 of the EGTTR (Figure 1). These areas are located offshore of the towns of Destin and Apalachicola on the Florida Panhandle.

1.1. Joint Air-to-Surface Stand-off Missile

The JASSM is a precision cruise missile designed for launch from outside area defenses to kill hard, medium-hardened, soft, and area type targets. The JASSM has a range of more than 200 NM and carries a 1,000-lb warhead. When live, the JASSM warhead has approximately 255 pounds of explosive (AFX-757), a type of plastic bonded explosive (PBX) formulation with higher blast characteristics and less sensitivity to many physical effects that could trigger unwanted explosions. AFX-757 uses less expensive ingredients and is easier to process than current commonly used explosives like tritonal and plastic bonded explosive 109 (PBXN-109). The JASSM has approximately 300 pounds of tri-nitro toluene (TNT) equivalent net explosive weight (NEW). The JASSM will be launched more than 200 NM from the target location. Platforms for the launch include the following aircraft: B-1, B-2, B-52, F-16, F-18, and F-117. Launch from the aircraft will occur at altitudes greater than 25,000 feet. The JASSM will cruise at altitudes greater than 12,000 feet for the majority of the flight profile until it makes the terminal maneuver toward the target.

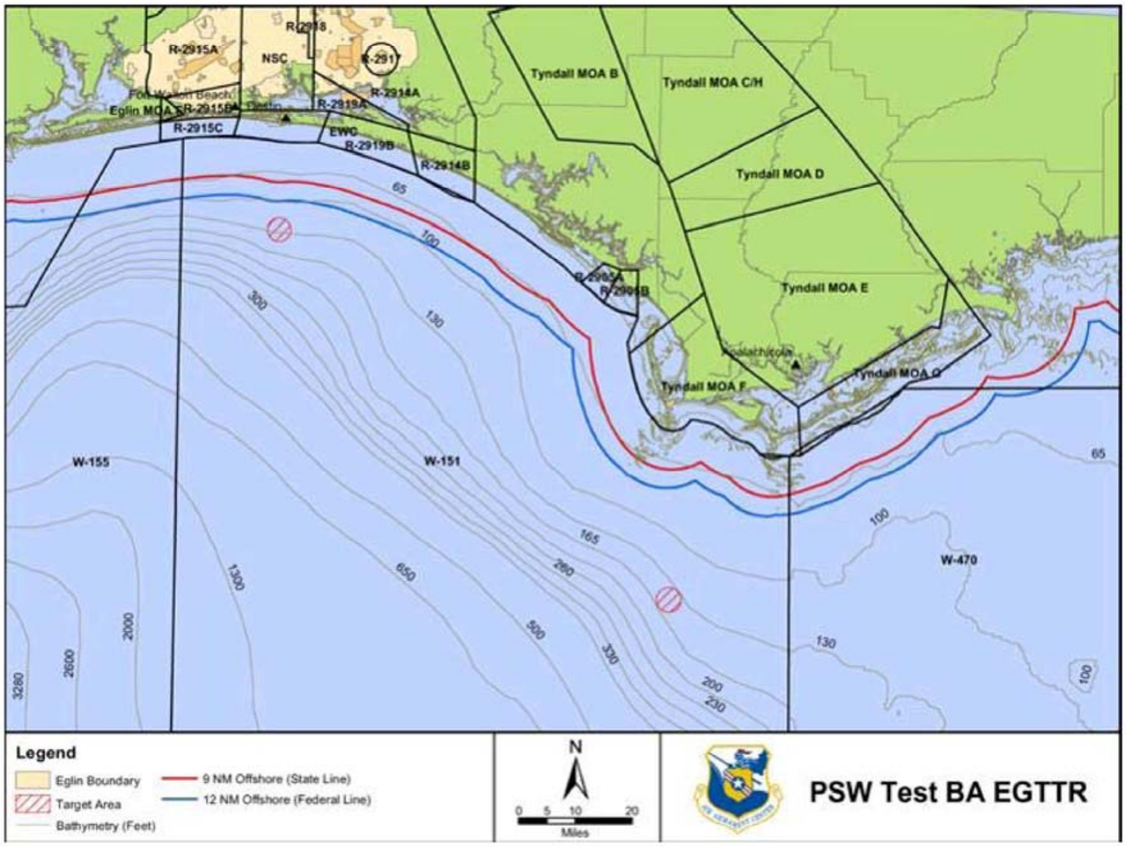

Figure 1. The two PSW test target locations within Warning Area 151 of the Eglin Gulf Test and Training Range. The target locations are approximately 15 to 24 NM from shore in water depths of approximately 45.7 m (25 fathoms).

As many as two live and four inert JASSM missiles per year will be launched from an aircraft above the GOM at a target on the surface of the water in one of the test areas. Detonation of the JASSM will occur under one of three scenarios:

1. Detonation upon impact with a target (about 5 feet above the GOM surface);
2. Detonation upon impact with a target at the surface of the GOM; or
3. Detonation at or just below the surface at 120 milliseconds after contact with the surface of the GOM.

1.2. Small-Diameter Bomb

The SDB weapon is a 250-lb class, air-to-surface, precision-guided munition. The SDB may be launched from medium-to-high altitudes in straight and level flight. SDB allows multiple target engagements on a single pass delivery. SDB uses a tightly coupled global positioning system (GPS)/inertial navigation system (INS)-guidance system and, with the use of foldout wings and control fins, has a range of over 40 NM. When live, the SDB warhead has approximately 40 lb of AFX-757. The SDB has approximately 48 lb of TNT equivalent NEW.

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As many as six live and 12 inert SDBs per year will also be dropped on a target. Detonation of the SDBs will occur under one of two scenarios:

1. Detonation of one or two bombs upon impact with the target (about 5 feet above the GOM surface); or
2. Height of burst (HOB) test: Detonation of one or two bombs 10 to 25 feet above the GOM surface.

1.3. Precision Strike Weapons Test Targets

There are two possible targets to be used for the PSW mission tests in the EGTTR. The first is a container express (CONEX) target that will consist of five containers strapped, braced, and welded together to form a single structure. The dimensions of each container are approximately 8 ft by 8 ft by 40 ft. Each container will contain two hundred 55-gal steel drums filled with air and sealed. These provide buoyancy to the target. The second possible target is a hopper barge, typical for transportation of grains, beans, or corn. The hopper barge is approximately 30 ft by 12 ft and 125 ft long. The targets will be held in place by a four-point anchoring system using cables.

The CONEX target will be constructed on land and shipped to the target location two to three days prior to the test. The barge target will also be stationed at target location two to three days prior to the test. GPS measurements at the target will be made and relayed to missile launchers as part of the preparation for each test. During an inert mission, the JASSM will pass through the target and the warhead will sink to the sea floor. The target will be towed in and used again. The CONEX boxes are compartmentalized and if one section is hit, the target will still float.

Immediately following impact, JASSM will pass through the target and the warhead will sink to the Gulf floor. The JASSM recovery team will pick up surface debris from the missile and target. Depending on the test schedule, the target may remain in the GOM for up to one month at a time. If the target is significantly damaged, and it is deemed impractical and unsafe to retrieve it, the target remains may be sunk by non-explosive methods, after coordination with the U.S. Army Corps of Engineers and U.S. Coast Guard.

1.4. Summary of Proposed Measures to Minimize Potential Impacts to Listed Species

Eglin has agreed to survey the zone of influence (ZOI) determined by NMFS, and a buffer zone which is twice the size of the ZOI. Prior to the mission, trained observers aboard a helicopter with proper surveying capabilities will survey (visually monitor) these zones, a very effective method for detecting sea turtles and cetaceans. The area to be surveyed will be in every direction from the target. In addition, trained observers aboard surface support vessels will conduct ship-based monitoring for protected species (all marine mammals and sea turtles). The helicopter or plane will fly approximately 500 ft above the sea surface to allow observers to scan the ZOI.

Eglin indicates that weather that supports the ability to sight small marine life (e.g., sea turtles) is required to mitigate the test site effectively. Wind, visibility, and surface conditions of the Gulf of Mexico are the most critical factors affecting mitigation operations. Higher winds typically

increase wave height and create "white cap" conditions, both of which limit an observer's ability to locate surfacing marine mammals and sea turtles. Eglin proposes to delay PSW missions if the sea state were greater than 3.5 (Table 1).

Table 1. Pierson - Moskowitz Sea Spectrum - Sea State Scale for Marine Mammal and Sea Turtle Observation.

Wind Speed (kts)	Sea State	Significant Wave (ft)	Significant Range of Periods (seconds)	Average Period (seconds)	Average Length of Waves (ft)
3	0	<.5	<.5 - 1	0.5	1.5
4	0	<.5	5 - 1	1	2
5	1	0.5	1 - 2.5	1.5	9.5
7	1	1	1 - 3.5	2	13
8	1	1	1 - 4	2	16
9	2	1.5	1.5 - 4	2.5	20
10	2	2	1.5 - 5	3	26
11	2.5	2.5	1.5 - 5.5	3	33
13	2.5	3	2 - 6	3.5	39.5
14	3	3.5	2 - 6.5	3.5	46
15	3	4	2 - 7	4	52.5
16	3.5	4.5	2.5 - 7	4	59
17	3.5	5	2.5 - 7.5	4.5	65.5

Visibility is also a critical factor for flight safety issues. A minimum ceiling of 305 meters (1,000 ft) and visibility of 5.6 kilometers (3 NM) is required to support mitigation and safety-of-flight concerns.

Aerial Survey/Monitoring Team

Eglin proposes to complete an aerial survey before each mission and adequately train personnel to conduct aerial surveys for protected species. The aerial survey/monitoring team will consist of two observers. Aircraft provides a preferable viewing platform for detection of protected marine species. Each aerial observer will be experienced in marine mammal and sea turtle surveying and be familiar with species that may occur in the area. Each aircraft will have a data recorder who will be responsible for relaying the location, the species if possible, the direction of movement, and the number of animals sighted. The aerial monitoring team will also identify large schools of fish, jellyfish aggregations, and any large accumulation of *Sargassum* that could potentially drift into the ZOI. Standard line transect aerial surveying methods will be used. Aerial observers are expected to have adequate sighting conditions at sunrise within the weather limitation noted previously. Observed marine mammals and sea turtles will be identified to the species or the lowest possible taxonomic level and the relative position recorded. Mission activity will occur no earlier than two hours after sunrise and no later than two hours prior to sunset to ensure adequate daylight and pre- and post-mission monitoring.

Shipboard Monitoring Team

Eglin proposes to conduct shipboard monitoring to reduce impacts to protected species. The monitoring will be staged from the highest point possible on a mission ship. Observers will be familiar with the marine life of the area. The observer on the vessel must be equipped with optical equipment with sufficient magnification, which should allow the observer to sight surfacing mammals and/or sea turtles and provide overlapping coverage from the aerial team. A team leader will be responsible for reporting sighting locations, which will be based on bearing and distance.

The aerial and shipboard monitoring teams will have proper lines of communication to avoid communication deficiencies. The observers from the aerial team and operations vessel will have direct communication with the lead scientist aboard the operations vessel. The lead scientist will be a qualified marine biologist familiar with marine surveys. The lead scientist reviews the range conditions and recommends a go/no-go decision to the test director. The test director makes the final decision to proceed with the test.

All zones (injury ZOI and buffer zones) will be monitored. Although unexpected, any mission may be delayed or aborted due to technical reasons, which can last several minutes up to a few hours. Actual delay times depend on the platforms (aircraft) supporting the test, test assets, and range time. Should such a technical delay occur, all mitigation procedures will continue and remain in place until either the test takes place or is canceled. The ZOI and buffer zone around JASSM missions will be effectively monitored by shipboard observers from the highest point (flybridge) of the vessel. Vessels will be positioned as close to the safety zone as allowed without infringing on the flight corridor. An SDB has many mission profiles and does not have a flight termination system; therefore, the safety buffer may be quite large (5-10 NM). The observation time will be less for SDB missions due to mandatory safety buffers which limit the time and type of mitigations. Even though mitigations may be limited for SDB missions, all detonations are above the water surface (5-25 feet above the surface) and of smaller net explosive weight than JASSM.

Table 2. The safety zones and clearance times before detonations for JASSM and SDB missions.

	Flight Time (min)	Safety Clearance Time for Vessels (min)	Safety Clearance Time for Aircraft (min)	Total Time of Vessel Safety Clearance before Detonation (min)	Total Time of Aircraft Safety Clearance (min)	Safety Area (radius)
JASSM	30 – 60	30	15	90	75	2 NM
SDB	20	60	30	80	50	5-10 NM

Pre-mission Monitoring

The purposes of pre-mission monitoring are to (1) evaluate the test site for environmental suitability of the mission and (2) verify that the ZOI is free of visually detectable marine mammals, sea turtles, large schools of fish, large flocks of birds, large *Sargassum* mats, and large concentrations of jellyfish. On the morning of the test, the lead scientist will confirm that the test sites can still support the mission and that the weather is adequate to support mitigation.

(a) Five Hours Prior to Launch

Approximately five hours prior to the launch, or at daybreak, the appropriate vessel(s) will be on-site in the primary test site near the location of the earliest planned mission point. Observers onboard the vessel will assess the suitability of the test site, based on visual observation of marine mammals and sea turtles, the presence of large *Sargassum* mats, and overall environmental conditions (visibility, sea state, etc.). This information will be relayed to the lead scientist.

(b) Two Hours Prior to Launch

Two hours prior to the launch, aerial monitoring will commence within the test site to evaluate the test site for environmental suitability. Evaluation of the entire test site will take approximately 1 to 1.5 hours. Shipboard observers will monitor the ZOI and buffer zone, and the lead scientist will enter all marine mammals and sea turtle sightings, including the time of sighting and the direction of travel, into a marine animal tracking and sighting database. The aerial monitoring team will begin monitoring the ZOI and buffer zone around the target area. The shipboard monitoring team will combine with the aerial team to monitor the area immediately around the mission area including both the ZOI and buffer zone. The shipboard monitoring teams will begin to migrate to the edge of the safety zone at approximately one hour before launch.

(c) One to 1.5 Hours Prior to Launch

Aerial and shipboard viewers will be instructed to leave the area and remain outside the safety area (over 2 NM from impact for JASSM and 5-10 NM for SDB). The aerial team will report all marine animals spotted and the directions of travel to the lead scientist onboard the vessel. The shipboard monitoring team will continue searching the buffer zone for protected species.

(d) Fifteen Minutes Prior to Launch and Go/No-Go Decision Process

Visual monitoring from surface vessels outside the safety zone will continue to document any missed animals that may have gone undetected during the past two hours and track animals moving in the direction of the impact area. The lead scientist will plot and record sightings and bearing for all marine animals detected. This will depict animal sightings relative to the mission area. The lead scientist will have the authority to declare the range fouled and recommend a hold until monitoring indicates that the ZOI is and will remain clear of detectable animals.
The mission will be postponed if:

1. Any marine mammal or sea turtle is visually detected within the ZOI. The delay will continue until the marine mammal or sea turtle that caused the postponement is confirmed to be outside of the ZOI due to the animal swimming out of the range.
2. Any marine mammal or sea turtle is detected in the buffer zone and subsequently cannot be reacquired. The mission will not continue until the last verified location is outside of the ZOI and the animal is moving away from the mission area.
3. Large *Sargassum* rafts or large concentrations of jellyfish are observed within the ZOI. The delay will continue until the *Sargassum* rafts or jellyfish that caused the postponement are confirmed to be outside of the ZOI either due to the current and/or wind moving them out of the mission area.
4. Large schools of fish are observed in the water within the ZOI. The delay will continue until the large fish schools are confirmed to be outside the ZOI.

In the event of a postponement, pre-mission monitoring will continue as long as weather and daylight hours allow.

(e) Launch to Impact

Visual monitoring from vessels will continue to survey the ZOI and surrounding buffer zone and track animals moving in the direction of the impact area. The lead scientist will continue to plot and record sightings and bearing for all marine animals detected. This is intended to depict animal sightings relative to the impact area.

If a live warhead failed to explode, the weapon will be rendered safe after fifteen minutes. The feasibility and practicality of recovering the warhead will be evaluated on a case-by-case basis. If at all feasible, the warhead will be recovered.

<u>Post-mission monitoring</u>: Post-mission monitoring is designed to determine the effectiveness of pre-mission mitigation by reporting any sightings of dead or injured marine mammals or sea turtles. Post-detonation monitoring via shipboard surveyors will commence immediately following each detonation. The vessels will move into the ZOI from outside the safety zone and continue monitoring for at least two hours, concentrating on the area down current of the test site.

Some marine mammals or sea turtles killed by an explosion might suffer lung rupture, which will cause them to float to the surface immediately due to air in the blood stream. The monitoring team will attempt to document any marine mammals or turtles that were killed or injured as a result of the test and, if practicable, recover and examine any dead animals. The species, number, location, and behavior of any animals observed by the observation teams will be documented and reported to the lead scientist.

Summary of Mitigation Plan

The test will be postponed if any human safety concerns arise, protected species are sighted within the ZOI, any protected species is detected in the buffer zone and subsequently cannot be reacquired, or a protected species is moving into the ZOI from the buffer zone. PSW testing will be delayed if definitive indicators of protective species (i.e., large *Sargassum* mats) are present. The delay will continue until the marine mammal, sea turtle, and/or indicators that caused the postponement is confirmed to be outside of the ZOI due to the animal swimming out of the range.

The safety vessels will conduct post-mission monitoring for two hours after each mission. The monitoring team will attempt to document any marine mammals or turtles that were killed or injured as a result of the test and, if practicable, recover and examine any dead animals.

Hardbottom habitats and artificial reefs will be avoided to alleviate any potential impacts to protected habitat. The PSW mission team will make every effort that is deemed safe to recover surface debris, from the target or the weapons following test activities.

Post-mission monitoring activities may include coordination with NMFS' marine mammal stranding networks organizations. Any observed dead or injured marine mammal or sea turtle will be reported to the appropriate marine mammal or sea turtle stranding coordinator.

Action Area

The action area includes Warning Area 151 (W-151). The two test locations are located within W-151 at a distance of approximately 15-24 NM from shore in 45.7 m of water (25 fathoms) (Figure 1). The action area is defined as the zones of influence both above and below the water, resulting from pressure waves, noise, and debris from PSW testing in these target locations.

2.0. Status of Listed Species and Critical Habitat

The following listed species under the jurisdiction of NMFS are known to occur in the GOM and may be affected by the proposed action:

Sea turtles	Scientific Name	Status
Leatherback	*Dermochelys coriacea*	Endangered
Green[1]	*Chelonia mydas*	Endangered
Hawksbill	*Eretmochelys imbricata*	Endangered
Kemp's ridley	*Lepidochelys kempii*	Endangered
Loggerhead	*Caretta caretta*	Threatened
Fishes		
Smalltooth sawfish	*Pristis pectinata*	Endangered
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Threatened

[1] Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

Gulf sturgeon critical habitat is near the action area, and discussed in greater detail below.

Analysis of Species and Critical Habitat Not Likely to be Affected by the Proposed Action

Hawksbill sea turtle (*Eretmochelys imbricata*) occurrences are expected to be rare in the action area, and this species will not be affected by the action. The largest hawksbill nesting population occurs in the Yucatán Peninsula of Mexico (Garduño-Andrade et al. 1999). With respect to the United States, nesting occurs in Puerto Rico, the United States Virgin Islands, and the southeast coast of Florida. Nesting also occurs outside of the United States in Antigua, Barbados, Costa Rica, Cuba, and Jamaica (Meylan 1999). Outside of the above nesting areas, hawksbills have been observed off the United States GOM states and strandings reported, although sightings north of Florida are rare (NMFS 2004). Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs, although other hard-bottom communities and occasionally mangrove-fringed bays may be occupied. Although hawksbills may occasionally be expected to be found in the action area, this species' habitats are found mainly along peninsular Florida and they are expected to be of low density and rare in the action area. This species occurs in such low numbers in the action area that it is not expected to be affected by PSW training.

Sperm whales are the most common large whale expected to be encountered in the GOM. Sperm whales inhabit deep water greater than 200 m. Because the proposed PSW test areas are located approximately 15-24 NM from shore in approximately 45.7 m of water (25 fathoms), sperm whales are not expected to be present in the action area of the training. Other endangered whales, including the blue (*Balaenoptera musculus*), sei (*B. borealis*), fin (*B. physalus*), humpback (*Megaptera novaeangliae*), and the North Atlantic right whale (*Eubalaena glacialis*) have been observed occasionally in the GOM. Individuals observed have likely been inexperienced juveniles straying from the normal range of these stocks or occasional transients. Since resident stocks of these species are not believed to be present in the GOM (Mullin et al. 1994, Würsig et al. 2000), the potential for interaction between any of the proposed activities and these whale species is extremely low. Therefore, no listed species of cetacean is expected to occur in the action area.

Historically, the smalltooth sawfish was common in neritic and coastal waters of Texas, Louisiana, Mississippi, and Alabama. Since 1971, however, there have been only three published or museum reports of the species captured in the region, all from Texas (1978, 1979, and 1984). The sawfish is now considered rare in the northern GOM and is primarily confined to southern Florida and the Florida Keys, but has been observed off the Florida Panhandle. Due to the limited geographic range of the smalltooth sawfish to southern Florida, the probability of a sawfish occurring offshore in the areas of the PSW training is so low the impacts are considered to be negligible.

Some adult Gulf sturgeon may potentially be found in the action area, but individuals are not expected to be affected by any direct or indirect effects resulting from PSW activities, since these activities are focused in localized areas. Subadult and adult Gulf sturgeon show a preference for shoreline habitats in water depths less than 3.5 meters, salinities less than 6.3 parts per thousand, and areas lacking in sea grasses (Parauka 2003 as cited in Eglin 2004), Fox et al. 2000). Although

feeding migrations occur, the available evidence indicates that Gulf sturgeon are generally limited to water depths of 20 ft or less. The PSW training is proposed to occur in depths of approximately 46 m, and the potential for any adverse effects occurring to Gulf sturgeon is so low as to be considered discountable as no sighting of Gulf sturgeon have occurred in depths greater than 6 m. Gulf sturgeon critical habitat was also considered, but excluded from the analysis, since we have determined that critical habitat is not found within the action area and no principal constituent elements will be destroyed or adversely modified by any indirect effects associated with the proposed action.

Based on the above determination that the distribution or occurrences of species are extremely unlikely to overlap with the action area, NMFS has determined that hawksbill sea turtles, sperm whales, blue whales, sei whales, fin whales, humpback whales, North Atlantic right whales, smalltooth sawfish, and Gulf sturgeon are not likely to be adversely affected by the proposed action and are excluded from further analysis.

Species Likely to be Affected by the Proposed Action

The following subsections are synopses of the current state of knowledge on the life history, distribution, and population trends of sea turtle species that may be affected by the proposed action. Additional background information on the range-wide status of these species can be found in a number of published documents, including: recovery plans for the United States population of loggerhead sea turtles (NMFS and USFWS 1991b), Kemp's ridley sea turtle (USFWS and NMFS 1992), green sea turtle (NMFS and USFWS 1991a), and leatherback sea turtle (NMFS and USFWS 1992); Pacific Sea Turtle Recovery Plans (NMFS and USFWS, 1998a-e) and sea turtle status reviews and biological reports (NMFS and USFWS 1995; Marine Turtle Expert Working Group (TEWG) 1998 and 2000, NMFS 2001).

Leatherback, green, Kemp's ridley, and loggerhead sea turtles are highly migratory or have migratory phases in their life histories. As a result, they are exposed to a multitude of anthropogenic sources of mortality throughout their ranges, such as fisheries and vessel traffic. In addition to anthropogenic factors, natural threats to nesting beaches and marine habitats such as coastal erosion, seasonal storms, predators, and temperature variations also affect the survival and recovery of sea turtle populations. As a result, sea turtles still face many of the original threats that were the cause of their listing under the ESA.

The detailed sea turtle species subsections below focus primarily on the Atlantic Ocean populations since these are the populations that may be affected by the proposed action. However, because these species are listed as global populations (with the exception of Kemp's ridleys and Florida greens, whose distribution is entirely in the Atlantic and GOM), the global status and trends of these species are included to provide a basis and frame of reference for our final determination of the effects of the proposed action on the species as listed under the ESA.

2.1. Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its global range on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters

of the Atlantic, Pacific, and Indian oceans; the Caribbean Sea; and the GOM (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. The large size and tolerance to relatively low temperatures allows adult leatherbacks to occur in northern waters, such as off Labrador and in the Barents Sea (NMFS and USFWS 1995). Adults forage in temperate and subpolar regions from 71°N to 47°S latitude in all oceans and undergo extensive migrations to and from their tropical nesting beaches. In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982). That number, however, is probably an overestimation as it was based on a particularly good nesting year in 1980 (Pritchard 1996). By 1995, this global population of adult females had declined to 34,500 (Spotila et al. 1996). Pritchard (1996) also called into question the population estimates from Spotila et al. (1996), and felt it may be somewhat low, because it ended the modeling on data from a particularly bad nesting year (1994) while excluding nesting data from 1995, which was a good nesting year. However, Spotila et al. (2000) represents the best overall estimate of adult female leatherback population size.

2.1.1. Pacific Ocean

Based on published estimates of nesting female abundance, leatherback populations have collapsed or have been declining at all major Pacific basin nesting beaches for the last two decades (Spotila et al. 1996; NMFS and USFWS 1998a; Sarti et al. 2000; Spotila et al. 2000). For example, the nesting assemblage on Terengganu, Malaysia – which was one of the most significant nesting sites in the western Pacific Ocean – has declined severely from an estimated 3,103 females in 1968 to two nesting females in 1994 (Chan and Liew 1996). Nesting assemblages of leatherback turtles are in decline along the coasts of the Solomon Islands, a historically important nesting area (D. Broderick, pers. comm., in Dutton et al. 1999). In Fiji, Thailand, Australia, and Papua New Guinea (East Papua), leatherback turtles have only been known to nest in low densities and scattered colonies.

Only an Indonesian nesting assemblage has remained relatively abundant in the Pacific basin. The largest extant leatherback nesting assemblage in the Indo-Pacific lies on the north Vogelkop coast of Irian Jaya (West Papua), Indonesia, with over 3,000 nests recorded annually (Putrawidjaja 2000; Suarez et al. 2000). During the early-to-mid 1980s, the number of female leatherback turtles nesting on the two primary beaches of Irian Jaya appeared to be stable. More recently, this population has come under increasing threats that could cause this population to experience a collapse that is similar to what occurred at Terengganu, Malaysia. In 1999, for example, local Indonesian villagers started reporting dramatic declines in sea turtle populations near their villages (Suarez 1999). Unless hatchling and adult turtles on nesting beaches receive more protection, this population will continue to decline. Declines in nesting assemblages of leatherback turtles have been reported throughout the western Pacific region, with nesting assemblages well below abundance levels observed several decades ago (e.g., Suarez 1999).

In the western Pacific Ocean and South China Sea, leatherback turtles are captured, injured, or killed in numerous fisheries, including Japanese longline fisheries. Leatherback turtles in the western Pacific are also threatened by poaching of eggs, killing of nesting females, human encroachment on nesting beaches, beach erosion, and egg predation by animals.

In the eastern Pacific Ocean, nesting populations of leatherback turtles are declining along the Pacific coast of Mexico and Costa Rica. According to reports from the late 1970s and early 1980s, three beaches on the Pacific coast of Mexico supported as many as half of all leatherback turtle nests for the eastern Pacific. Since the early 1980s, the eastern Pacific Mexican population of adult female leatherback turtles has declined to slightly more than 200 individuals during 1998-1999 and 1999-2000 (Sarti et al. 2000). Spotila et al. (2000) reported the decline of the leatherback turtle population at Playa Grande, Costa Rica, which had been the fourth largest nesting colony in the world. Between 1988 and 1999, the nesting colony declined from 1,367 to 117 female leatherback turtles. Based on their models, Spotila et al. (2000) estimated that the colony could fall to less than 50 females by 2003-2004. Leatherback turtles in the eastern Pacific Ocean are captured, injured, or killed in commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific Ocean; and California/Oregon drift gillnet fisheries. Because of the limited data, we cannot provide high-certainty estimates of the number of leatherback turtles captured, injured, or killed through interactions with these fisheries. However, between 8 and 17 leatherback turtles were estimated to have died annually between 1990 and 2000 in interactions with the California/Oregon drift gillnet fishery; 500 leatherback turtles are estimated to die annually in Chilean and Peruvian fisheries; 200 leatherback turtles are estimated to die in direct harvests in Indonesia; and before 1992, the North Pacific driftnet fisheries for squid, tuna, and billfish captured an estimated 1,000 leatherback turtles each year, killing about 111 of them each year (NMFS 2004).

Although all causes of the declines in leatherback turtle colonies in the eastern Pacific have not been documented, Sarti et al. (1998) suggest that the declines result from egg poaching, adult and sub-adult mortalities incidental to high seas fisheries, and natural fluctuations due to changing environmental conditions. Some published reports support this suggestion. Sarti et al. (2000) reported that female leatherback turtles have been killed for meat on nesting beaches like Piedra de Tiacoyunque, Guerrero, Mexico. Eckert (1997) reported that swordfish gillnet fisheries in Peru and Chile contributed to the decline of leatherback turtles in the eastern Pacific. The decline in the nesting population at Mexiquillo, Mexico, occurred at the same time that effort doubled in the Chilean driftnet fishery. In response to these effects, the eastern Pacific population has continued to decline, leading some researchers to conclude that the leatherback is on the verge of extinction in the Pacific Ocean (e.g., Spotila et al. 1996; Spotila et al. 2000). NMFS' assessment of three nesting aggregations supports this conclusion (NMFS 2004): if no action is taken to reverse their decline, leatherback sea turtles nesting in the Pacific Ocean either have high risks of extinction in a single human generation (e.g., nesting aggregations at Terrenganu and Costa Rica) or they have a high risk of declining to levels where more precipitous declines become almost certain (e.g., Irian Jaya) (NMFS 2004).

2.1.2. Atlantic Ocean

In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS 2001). Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Suriname (NMFS 2001).

Genetic analyses of leatherbacks to date indicate that within the Atlantic basin there are genetically different nesting populations; the St. Croix nesting population (United States Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana) and the Trinidad nesting population (Dutton et al. 1999). When the hatchlings leave the nesting beaches, they move offshore but eventually utilize both coastal and pelagic waters. Very little is known about the pelagic habits of the hatchlings and juveniles, and they have not been documented to be associated with the *Sargassum* areas as are other species. Leatherbacks are deep divers, with recorded dives to depths in excess of 1,000 m (Hayes et al. 2004).

Life history and distribution

Leatherbacks are a long-lived species, living for over 30 years. They reach sexual maturity somewhat faster than other sea turtles (except Kemp's ridley), with an estimated range from 3-6 years (Rhodin 1985) to 13-14 years (Zug and Parham 1996). They nest frequently (up to10 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30%) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. The eggs will incubate for 55-75 days before hatching. Based on a review of all sightings of leatherback sea turtles of <145 cm curved carapace length (ccl), Eckert (1999) found that leatherback juveniles remain in waters warmer than 26EC until they exceed 100 cm ccl.

Leatherbacks are the most pelagic of the sea turtles, but enter coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates.

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between boreal, temperate, and tropical waters (NMFS and USFWS 1992). A 1979 aerial survey of the outer continental shelf from Cape Hatteras, North Carolina, to Cape Sable, Nova Scotia, showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in waters where depths ranged from 1-4151 m, but 84.4% of sightings were in areas where the water was less than 180 m deep (Shoop and Kenney 1992). Leatherbacks were sighted in waters of a similar sea surface temperature as loggerheads; from 7EC-27.2EC (Shoop and Kenney 1992). However, this species appears to have a greater tolerance for colder waters because more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). This aerial survey estimated the in-water leatherback population from near Nova Scotia, Canada, to Cape Hatteras, North Carolina, at approximately 300-600 animals.

Population dynamics and status

The status of the Atlantic leatherback population is less clear than the Pacific population. The total Atlantic population size is undoubtedly larger than in the Pacific, but overall population trends are unclear. In 1996, the entire western Atlantic population was characterized as stable at

best (Spotila et al. 1996), with numbers of nesting females reported to be on the order of 18,800. A subsequent analysis by Spotila (pers. comm.) indicated that by 2000, the western Atlantic nesting population had decreased to about 15,000 nesting females. According to NMFS (2001) the nesting aggregation in French Guiana has been declining at about 15% per year since 1987. However, from 1979-1986, the number of nests was increasing at about 15% annually which could mean that the current 15% decline could be part of a nesting cycle which coincides with the erosion cycle of Guiana beaches described by Schultz (1975). In Suriname, leatherback nest numbers have shown large recent increases (with more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001), and the long-term trend for the overall Suriname and French Guiana population may show an increase (Girondot 2002 in Hilterman and Goverse 2003). The number of nests in Florida and the United States Caribbean has been increasing at about 10.3% and 7.5%, respectively, per year since the early 1980s but the magnitude of nesting is much smaller than that along the French Guiana coast (NMFS 2001). Also, because leatherback females can lay 10 nests per season, the recent increases to 400 nests per year in Florida may only represent as few as 40 individual female nesters per year.

In summary, the conflicting information regarding the status of Atlantic leatherbacks makes it difficult to characterize the current status. Numbers at some nesting sites are increasing, but are decreasing at other sites. Tag return data emphasize the wide-ranging nature of the leatherback and the link between South American nesters and animals found in United States waters. For example, a nesting female tagged May 29, 1990, in French Guiana was later recovered and released alive from the York River, Virginia. Another nester tagged in French Guiana on June 21, 1990, was later found dead in Palm Beach, Florida (STSSN database). Genetic studies performed during the Northeast Distant Fishery Experiment (NED) indicated that leatherbacks captured in the pelagic longline fishery were primarily from the French Guiana and Trinidad nesting stocks (over 95%), though individuals from West African stocks were surprisingly absent (Roden et al. In press).

There are a number of problems contributing to the uncertainty of the leatherback nest counts and population assessments. The nesting beaches of the Guianas (Guyana, French Guiana, and Suriname) and Trinidad are by far the most important in the western Atlantic. However, beaches in this region undergo cycles of erosion and reformation, so that the nesting beaches are not consistent over time. Additionally, leatherback sea turtles do not exhibit the same degree of nest-site fidelity demonstrated by loggerhead and other hard-shell sea turtles, further confounding analysis of population trends using nesting data. Reported declines in one country and reported increases in another may be the result of migration and beach changes, not true population changes. Nesting surveys, as well as being hampered by the inconsistency of the nesting beaches, are themselves inconsistent throughout the region. Survey effort varies widely in the seasonal coverage, areal coverage, and actual surveyed sites. Surveys have not been conducted consistently throughout time, or have even been dropped entirely as the result of wars, political turmoil, funding vagaries, etc. The methods vary in assessing total numbers of nests and total numbers of females. Many sea turtle scientists agree that the Guianas (and some would include Trinidad) should be viewed as one population and that a synoptic evaluation of nesting at all beaches in the region is necessary to develop a true picture of population status (Reichart 2001). No such region-wide assessment has been conducted recently.

The most recent, complete estimates of regional leatherback populations are in Spotila et al. (1996). As discussed above, nesting in the Guianas may have been declining in the late 1990s but may have increased again in the early 2000s. Spotila et al. estimated that the leatherback population for the Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa totaled approximately 27,600 nesting females, with an estimated range of 20,082-35,133. We believe that the current population probably still lies within this range, taking into account the reported nesting declines and increases and the uncertainty surrounding them. We therefore choose to rely on Spotila et al.'s (1996) published total Atlantic population estimates, rather than attempt to construct a new population estimate here, based on our interpretation of the various, confusing nesting reports from areas within the region.

Threats

Zug and Parham (1996) pointed out that the main threat to leatherback populations in the Atlantic is the combination of fishery-related mortality (especially entanglement in gear and drowning in trawls) and the intense egg harvesting on the main nesting beaches. Other important ongoing threats to the population include pollution, loss of nesting habitat, and boat strikes.

Of the turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, possibly their method of locomotion, and perhaps to the lightsticks used to attract target species in longline fisheries. They are also susceptible to entanglement in gillnets and pot/trap lines (used in various fisheries) and capture in trawl gear (e.g., shrimp trawls).

Leatherbacks are exposed to pelagic longline fisheries in many areas of their range. Unlike loggerhead turtle interactions with longline gear, leatherback turtles do not usually ingest longline bait. Instead, leatherbacks are foul hooked by longline gear (e.g., on the flipper or shoulder area) rather than mouth hooked or swallowing the hook. According to observer records, an estimated 6,363 leatherback sea turtles were caught by the United States Atlantic tuna and swordfish longline fisheries between 1992-1999, of which 88 were released dead (NMFS 2001). The United States fleet accounts for only 5%-8% of the hooks fished in the Atlantic Ocean, and adding up the under-represented observed takes of the other 23 countries that actively fish in the area would lead to annual take estimates of thousands of leatherbacks over different life stages. Basin-wide, Lewison et al. (2004) estimated that 30,000-60,000 leatherback sea turtle captures occurred in Atlantic pelagic longline fisheries in the year 2000 alone (note that multiple captures of the same individual are known to occur, so the actual number of individuals captured may not be as high).

Leatherbacks are also susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer et al. 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer et al. 2002). Fixed gear fisheries in the Mid-Atlantic have also contributed to leatherback entanglements. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras

Inlet (D. Fletcher, pers. comm. to S. Epperly). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound near Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (D. Fletcher, pers. comm. to S. Epperly). In the Southeast, leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries. In the United States Virgin Islands, where one of five leatherback strandings from 1982 to 1997 was due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to J. Braun-McNeill). Because many entanglements of this typically pelagic species likely go unnoticed, entanglements in fishing gear may be much higher.

Leatherback interactions with the southeast Atlantic shrimp fishery, which operates predominantly from North Carolina through southeast Florida (NMFS 2002), have also been a common occurrence. Leatherbacks, which migrate north annually, are likely to encounter shrimp trawls working in the coastal waters off the Atlantic coast from Cape Canaveral, Florida to the Virginia/North Carolina border. For many years, turtle excluder devices (TEDs) that were required for use in the southeast shrimp fishery were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, NMFS issued a final rule to amend the TED regulations. Modifications to the design of TEDs are now required in order to exclude leatherbacks and large and sexually mature loggerhead and green turtles. Other trawl fisheries are also known to interact with leatherback sea turtles. In October 2001, a Northeast Fisheries Science Center (NEFSC) observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off of Delaware; TEDs are not required in this fishery. The winter trawl flounder fishery, which did not come under the revised TED regulations, may also interact with leatherback sea turtles.

Gillnet fisheries operating in the nearshore waters of the Mid-Atlantic states are also suspected of capturing, injuring, and/or killing leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the NEFSC Fisheries Observer Program from 1994 through 1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54% to 92%.

Poaching is not known to be a problem for nesting populations in the continental United States However, the NMFS (2001) notes that poaching of juveniles and adults is still occurring in the United States Virgin Islands and the Guianas. In all, four of the five strandings in St. Croix were the result of poaching (Boulon 2000). A few cases of fishermen poaching leatherbacks have been reported from Puerto Rico, but most of the poaching is on eggs.

Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding areas and migratory routes (Lutcavage et al. 1997; Shoop and Kenney 1992). Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44% of the 16 cases examined) contained plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13%) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between

prey items and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that the object may resemble a food item by its shape, color, size, or movement as it drifts about, and induce a feeding response in leatherbacks.

It is important to note that, like marine debris, fishing gear interactions and poaching are problems for leatherbacks throughout their range. Entanglements are common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear, including salmon net, herring net, gillnet, trawl line and crab pot line. Leatherbacks are reported taken by many other nations that participate in Atlantic pelagic longline fisheries, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, United Kingdom, Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (see NMFS 2001 for a description of take records). Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo et al. 1994, Graff 1995). Gillnets are one of the suspected causes for the decline in the leatherback sea turtle population in French Guiana (Chevalier et al. 1999), and gillnets targeting green and hawksbill turtles in the waters of the Caribbean coast of Nicaragua also incidentally catch leatherback turtles (Lagueux et al. 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio 2000). An estimated 1,000 mature female leatherback sea turtles are caught annually in fishing nets off of Trinidad and Tobago with mortality estimated to be between 50% and 95% (Eckert and Lien 1999). However, many of the turtles do not die as a result of drowning, but rather because the fishermen butcher them in order to get them out of their nets (NMFS 2001).

2.1.3. Summary of Leatherback Status

In the Pacific Ocean, the abundance of leatherback turtle nesting individuals and colonies has declined dramatically over the past 10 to 20 years. Nesting colonies throughout the eastern and western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females. In addition, egg poaching has reduced the reproductive success of the remaining nesting females. At current rates of decline, leatherback turtles in the Pacific basin are a critically endangered species with a low probability of surviving and recovering in the wild.

In the Atlantic Ocean, our understanding of the status and trends of leatherback turtles is much more confounded, although the picture does not appear nearly as bleak as in the Pacific. The number of female leatherbacks reported at some nesting sites in the Atlantic Ocean has increased, while at others they have decreased. Some of the same factors that led to precipitous declines of leatherbacks in the Pacific also affect leatherbacks in the Atlantic: leatherbacks are captured and killed in many kinds of fishing gear and interact with fisheries in state, federal, and international waters. Poaching is a problem and affects leatherbacks that occur in United States waters. Leatherbacks also appear to be more susceptible to death or injury from ingesting marine debris than other turtle species.

2.2. Green Sea Turtle

Federal listing of the green sea turtle occurred on July 28, 1978, with all populations listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are endangered. The nesting range of the green sea turtle in the southeastern United States includes sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands between Texas and North Carolina and the U. S. Virgin Islands (United States Virgin Islands) and Puerto Rico (NMFS and USFWS 1991a). Principal U. S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard through Broward counties (Ehrhart and Witherington 1992). Green sea turtle nesting also occurs regularly on St. Croix, United States Virgin Islands, and on Vieques, Culebra, Mona, and the main island of Puerto Rico (Mackay and Rebholz 1996).

2.2.1. Pacific Ocean

Green turtles are thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, from a combination of overexploitation and habitat loss (Seminoff 2002). In the western Pacific, the only major (>2,000 nesting females) populations of green turtles occur in Australia and Malaysia, with smaller colonies throughout the area. Indonesia has a widespread distribution of green turtles, but has experienced large declines over the past 50 years. The Hawaii green turtles are genetically distinct and geographically isolated, and the population appears to be increasing in size despite the prevalence of fibropapilloma and spirochidiasis (Aguirre et al. 1998 in Balazs and Chaloupka, in press). In the Eastern Pacific, mitochondrial DNA analysis has indicated that there are three key nesting populations: Michoacan, Mexico; Galapagos Islands, Ecuador; and Islas Revillagigedos, Mexico (Dutton 2003). There is also sporadic green turtle nesting along the Pacific coast of Costa Rica.

2.2.2. Atlantic Ocean

Life history and distribution

The estimated age at sexual maturity for green sea turtles is between 20-50 years (Balazs 1982, Frazer and Ehrhart 1985). Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1-7 clutches (usually 2-3) during the breeding season at 12-14 day intervals. Mean clutch size is highly variable among populations, but averages 110-115 eggs/nest. Females usually have 2-4 or more years between breeding seasons, whereas males may mate every year (Balazs 1983). After hatching, green sea turtles go through a post-hatchling pelagic stage where they are associated with drift lines of algae and other debris. At approximately 20 to 25 cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas (Bjorndal 1997).

Green sea turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The post-hatchling, pelagic-stage individuals are assumed to be omnivorous, but little data are available.

Green sea turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or sea grasses. This includes areas near mainland coastlines, islands, reefs, or shelves, and any open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997, NMFS and USFWS 1991a). Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984, Hildebrand 1982, Shaver 1994), the GOM off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957, Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon System, Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward counties (Wershoven and Wershoven 1992, Guseman and Ehrhart 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs.

Population dynamics and status

The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). It is known that current nesting levels in Florida are reduced compared to historical levels, but the extent of the reduction is not known (Dodd 1981). However, green sea turtle nesting in Florida has been increasing since 1989 (Florida Fish and Wildlife Conservation Commission, Florida Wildlife Research Institute Index Nesting Beach Survey Database). Total nest counts and trends at index beach sites during the past decade suggest the numbers of green sea turtles that nest within the southeastern United States are increasing.

Although nesting activity is obviously important in determining population distributions, the remaining portion of the green turtle's life is spent on the foraging and breeding grounds. Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1997). The summer developmental habitat for green turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997).

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas (where they come to forage) of the southeastern United States. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant (they have averaged 215 green sea turtle captures per year since 1977) in St. Lucie County, Florida (on the Atlantic coast of Florida), show that the annual number of immature green sea turtles captured has increased significantly in the past 26 years (FPL 2002).

It is likely that immature green sea turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches,

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principally Florida, Yucatán, and Tortuguero. Trends at Florida beaches were previously discussed. Trends in nesting at Yucatán beaches cannot be assessed because of a lack of consistent beach surveys over time. Trends at Tortuguero (ca. 20,000-50,000 nests/year) showed a significant increase in nesting during the period 1971-1996 (Bjorndal et al. 1999), and more recent information continues to show increasing nest counts Schroeder pers. comm.). Therefore, it seems reasonable that there is an increase in immature green sea turtles inhabiting coastal areas of the southeastern United States; however, the magnitude of this increase is unknown.

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of green sea turtles for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside United States jurisdiction, where exploitation is still a threat. However, there are still significant and ongoing threats to green sea turtles from human-related causes in the United States. These threats include beach armoring, erosion control, artificial lighting, beach disturbance e.g., driving on the beach), pollution, foraging habitat loss as a result of direct destruction by dredging, siltation, boat damage, other human activities, and interactions with fishing gear. Sea sampling coverage in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles. There is also the increasing threat from green sea turtle fibropapillomatosis disease. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida Herbst 1994, Jacobson 1990, Jacobson et al. 1991).

2.2.3. Summary of Status for Green Sea Turtles

Green turtles range in the western Atlantic from Massachusetts to Argentina, including the GOM and Caribbean, but are considered rare in benthic areas north of Cape Hatteras (Wynne and Schwartz 1999). Green turtles face many of the same natural and anthropogenic threats as for loggerhead sea turtles described above. In addition, green turtles are also susceptible to fibropapillomatosis, which can result in death. In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida. Recent population estimates for the western Atlantic area are not available. However, the pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the 10 years of regular monitoring since establishment of index beaches in 1989. However, given the species' late sexual maturity, caution is warranted about extrapolating trends in nesting data collected for less than 15 years.

2.3. Kemp's ridley Sea Turtle

The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Zwinenberg 1977, Groombridge 1982, Turtle Expert Working Group 2000). Kemp's ridleys nest primarily at Rancho Nuevo, a stretch of beach in Mexico, Tamaulipas State. The species occurs mainly in coastal areas of the GOM and the northwestern Atlantic Ocean. Occasional individuals reach European waters (Brongersma 1972). Adults of this species are usually confined to the GOM, although adult-sized individuals

sometimes are found on the east coast of the United States. This species occurs only in the Atlantic Ocean and GOM.

Life history and distribution

The Turtle Expert Working Group estimates age at sexual maturity from 7-15 years. Females return to their nesting beach about every two years (1998). Nesting occurs from April into July and is essentially limited to the beaches of the western GOM, near Rancho Nuevo in southern Tamaulipas, Mexico. The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season.

Little is known of the movements of the post-hatching stage (pelagic stage) within the GOM. Studies have shown the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell 1997). Benthic immature Kemp's Ridleys have been found along the United States Atlantic coast and in the GOM. Atlantic benthic immature sea turtles travel northward as the water warms to feed in the productive, coastal waters off Georgia through New England, returning southward with the onset of winter (Lutcavage and Musick 1985, Henwood and Ogren 1987, Ogren 1989). Studies suggest that benthic immature Kemp's ridleys stay in shallow, warm, nearshore waters in the northern GOM until cooling waters force them offshore or south along the Florida coast (Renaud 1995).

Stomach contents of Kemp's ridleys along the lower Texas coast consisted of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991). Pelagic-stage Kemp's ridleys presumably feed on the available *Sargassum* and associated infauna or other epipelagic species found in the GOM.

Population dynamics and status

Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the Rancho Nuevo beaches (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid1980s nesting numbers were below 1,000 (with a low of 702 nests in 1985). However, observations of increased nesting (with 6,277 nests recorded in 2000) suggest that the decline in the ridley population has stopped and the population is now increasing (USFWS 2000).

A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles beginning in 1990. The increased survivorship of immature sea turtles is attributable, in part, to the introduction of turtle excluder devices (TEDs) in the United States and Mexican shrimping fleets. As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by the Turtle Expert Working Group (2000) projected that Kemp's ridleys could reach the Recovery Plan's intermediate recovery goal of 10,000 nesters by the year 2015.

Next to loggerheads, Kemp's ridleys are the second most abundant sea turtle in Virginia and Maryland waters, arriving in these areas during May and June (Keinath et al. 1987, Musick and Limpus 1997). The juvenile population of Kemp's ridley sea turtles in Chesapeake Bay is estimated to be 211 to 1,083 turtles (Musick and Limpus 1997). These juveniles frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Kemp's ridleys consume a variety of crab species, including *Callinectes spp*., *Ovalipes spp*., *Libinia sp*., and *Cancer spp*. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). Upon leaving Chesapeake Bay in autumn, juvenile ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined there by juveniles of the same size from North Carolina sounds and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the GOM (Musick and Limpus 1997, Epperly et al. 1995a, Epperly et al. 1995b).

Threats

Kemp's ridleys face many of the same natural threats as loggerheads, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold-stunning. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. For example, in the winter of 1999-2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and 5 green turtles were found on Cape Cod beaches (R. Prescott, pers. comm.). Annual cold-stunning events do not always occur at this magnitude; the extent of episodic major cold stun events may be associated with numbers of turtles utilizing Northeast waters in a given year, oceanographic conditions, and the occurrence of storm events in the late fall. Although many cold-stunned turtles can survive if found early enough, cold-stunning events can represent a significant cause of natural mortality.

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impacts similar to those discussed above. For example, in the spring of 2000, a total of five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. Cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. The five ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction since it is unlikely that all of the carcasses washed ashore.

2.3.1. Summary of Kemp's Ridley Status

The only major nesting site for ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3% per year from 1985 to 1999. Current totals exceed 3,000 nests per year (Turtle Expert Working Group 2000). Kemp's ridleys mature at an earlier age (7-15 years) than other chelonids, thus 'lag effects' as a result of unknown impacts to the

non-breeding life stages would likely have been seen in the increasing nest trend beginning in 1985 (NMFS and USFWS 1992).

The largest contributors to the decline of Kemp's ridleys in the past were commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the GOM trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches have allowed the species to begin to rebound. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development, and tourism pressures.

2.4. Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. It was listed because of direct take, incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic Ocean, Pacific Ocean, Indian Ocean, Caribbean Sea and Mediterranean Sea. In the Atlantic, developmental habitat for small juveniles is the pelagic waters of the North Atlantic and the Mediterranean Sea (NMFS and USFWS 1991b). Within the continental United States, loggerhead sea turtles nest from Texas to New Jersey. Major nesting areas include coastal islands of Georgia, South Carolina, and North Carolina, and the Atlantic and Gulf coasts of Florida, with the bulk of the nesting occurring on the Atlantic coast of Florida.

2.4.1. Pacific Ocean

In the Pacific Ocean, major loggerhead nesting grounds are generally located in temperate and subtropical regions with scattered nesting in the tropics. Within the Pacific Ocean, loggerhead sea turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in eastern Australia (Great Barrier Reef and Queensland) and New Caledonia (NMFS 2001). There are no reported loggerhead nesting sites in the eastern or central Pacific Ocean basin. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead turtles (Bolten et al. 1996). Recent genetic analyses on female loggerheads nesting in Japan suggest that this "subpopulation" is comprised of genetically distinct nesting colonies (Hatase et al. 2002) with precise natal homing of individual females. As a result, Hatase et al. (2002) indicate that loss of one of these colonies would decrease the genetic diversity of Japanese loggerheads; recolonization of the site would not be expected on an ecological time scale. In Australia, long-term census data has been collected at some rookeries since the late 1960s and early 1970s, and nearly all the data show marked declines in nesting populations since the mid 1980s (Limpus and Limpus 2003). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

Pacific loggerhead turtles are captured, injured, or killed in numerous Pacific fisheries including Japanese longline fisheries in the western Pacific Ocean and South China Seas; direct harvest and commercial fisheries off the Baja, Mexico; commercial and artisanal swordfish fisheries off Chile, Columbia, Ecuador, and Peru; purse seine fisheries for tuna in the eastern tropical Pacific

Ocean; and California/Oregon drift gillnet fisheries. In addition, the abundance of loggerhead turtles on nesting colonies throughout the Pacific basin has declined dramatically over the past 10 to 20 years. Loggerhead turtle colonies in the western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females and reduced the reproductive success of females that manage to nest (e.g., due to egg poaching).

2.4.2. Atlantic Ocean

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. There are at least five western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29°N; (2) a south Florida nesting subpopulation, occurring from 29°N on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez 1990 and Turtle Expert Working Group 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001). The fidelity of nesting females to their nesting beach is the reason these subpopulations can be differentiated from one another. Fidelity for nesting beaches results in colonization of nesting sea turtles from other subpopulations unlikely.

Life history and distribution

Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985, Frazer et al. 1994) with the benthic immature stage lasting at least 10-25 years. However, based on new data from tag returns, strandings, and nesting surveys NMFS (2001) estimated ages of maturity ranging from 20-38 years and benthic immature stage lasting from 14-32 years.

Mating takes place in late March-early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern United States. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests/individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd 1988). Generally, loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years or more. Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the United States Atlantic and GOM, although some loggerheads may move back and forth between the pelagic and benthic environment (Witzell 2002). Benthic immature loggerheads (sea turtles that have come back to inshore and nearshore waters), the life stage following the pelagic immature stage, have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in northeastern Mexico.

Tagging studies have shown loggerheads which have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Within the

action area of this consultation, loggerhead sea turtles occur year round in offshore waters off of North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly et al. 1995c, Epperly et al. 1995 a, Epperly et al. 1995b), occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June. The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid September but some may remain in mid Atlantic and northeast areas until late fall. By December loggerheads have emigrated from inshore North Carolina waters and coastal waters to the north to waters offshore of North Carolina, particularly off Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (∃11EC) (Epperly et al. 1995c, Epperly et al. 1995a, Epperly et al. 1995b). Loggerhead sea turtles are year-round residents of central and south Florida. Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988). Sub-adult and adult loggerheads are primarily coastal and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

Population dynamics and status

A number of stock assessments (Turtle Expert Working Group 1998, Turtle Expert Working Group 2000, NMFS 2001, Heppell et al. 2003) have examined the stock status of loggerheads in the waters of the United States, but have been unable to develop any reliable estimates of absolute population size. Based on nesting data of the five western Atlantic subpopulations, the south Florida-nesting and the northern-nesting subpopulations are the most abundant (Turtle Expert Working Group 2000 and NMFS 2001). Between 1989 and 1998, the total number of nests laid along the United States Atlantic and Gulf coasts ranged from 53,014 to 92,182, annually with a mean of 73,751 (Turtle Expert Working Group 2000). On average, 90.7% of these nests were of the south Florida subpopulation and 8.5% were from the northern subpopulation (Turtle Expert Working Group 2000). The Turtle Expert Working Group's (2000) assessment of the status of these two better-studied populations concluded that the south Florida subpopulation is increasing, while no trend is evident (maybe stable but possibly declining) for the northern subpopulation. However, more recent analysis, including nesting data through 2003, indicate that there is no discernable trend in the south Florida nesting subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Wildlife Research Institute, Statewide and Index Nesting Beach Survey Programs). Another consideration that may add to the importance and vulnerability of the northern subpopulation is the sex ratios of this subpopulation. NMFS' scientists have estimated that the northern subpopulation produces 65% males (NMFS 2001). However, new research conducted over a limited time frame has found sex ratios opposite to this (Wyneken et al. 2004), and so further information is needed to clarify the issue. Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the northern subpopulation is related to the number of female hatchlings that are produced. Producing fewer females will limit the number of subsequent offspring produced by the subpopulation.

The remaining three subpopulations (the Dry Tortugas, Florida Panhandle, and Yucatán) are much smaller subpopulations but no less relevant to the continued existence of the species.

Nesting surveys for the Dry Tortugas subpopulation are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2003 (although the 2002 year was missed). Nest counts ranged from 168-270 but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Wildlife Research Institute, Statewide Nesting Beach Survey Data). Nest counts for the Florida Panhandle subpopulation are focused on index beaches rather than all beaches where nesting occurs. Currently, there is not enough information to detect a trend for the subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Wildlife Research Institute, Index Nesting Beach Survey Database). Similarly, nesting survey effort has been inconsistent among the Yucatán nesting beaches and no trend can be determined for this subpopulation. However, there is some optimistic news. Zurita et al. (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico, from 1987-2001 where survey effort was consistent during the period.

Threats

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts both in terrestrial and aquatic environments. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms as well as wave action can appreciably reduce hatchling success. For example, in 1992, all of the eggs over a 90-mile length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton et al. 1994). Other sources of natural mortality include cold stunning and biotoxin exposure.

Anthropogenic factors that impact hatchlings and adult female turtles on land, or the success of nesting and hatching include: beach erosion, beach armoring and nourishment, artificial lighting, beach cleaning, increased human presence, recreational beach equipment, beach driving, coastal construction and fishing piers, exotic dune and beach vegetation, and poaching. An increase in human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs, and an increased presence of native species (e.g., raccoons, armadillos, and opossums) which raid and feed on turtle eggs. Although sea turtle nesting beaches are protected along large expanses of the northwest Atlantic coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density east Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development and transportation, marine pollution, underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions. In the pelagic environment loggerheads are exposed to a series of longline fisheries that include the pelagic longline fisheries, and Azorean longline fleet, a Spanish longline fleet, and various fleets in the Mediterranean Sea (Aguilar et al. 1995, Crouse 1999). In the benthic environment in waters off the coastal United States, loggerheads are exposed to a suite of

fisheries in the federal and state waters including trawl, purse seine, hook and line, gillnet, pound net, longline, and trap fisheries (see further discussion in the Environmental Baseline of this opinion).

2.4.3. Summary of Status for Loggerhead Sea Turtles

In the Pacific Ocean, loggerhead turtles are represented by a northwestern Pacific nesting aggregation (located in Japan) and a smaller southwestern nesting aggregation that occurs in Australia (Great Barrier Reef and Queensland) and New Caledonia. The abundance of loggerhead turtles on nesting colonies throughout the Pacific basin have declined dramatically over the past 10 to 20 years. Data from 1995 estimated the Japanese nesting aggregation at 1,000 female loggerhead turtles (Bolten et al. 1996), but it has probably declined since 1995 and continues to decline (Tillman 2000). The nesting aggregation in Queensland, Australia, was as low as 300 females in 1997.

In the Atlantic Ocean, absolute population size is not known, but based on extrapolation of nest numbers, loggerheads are likely much more numerous than in the Pacific Ocean due to the greater number of hatchlings recruited into the population annually. NMFS recognizes five subpopulations of loggerhead sea turtles in the western north Atlantic based on genetic studies. Cohorts from all of these are known to occur within the action area of this consultation. There are no detectable nesting trends for the two largest western Atlantic subpopulations: the South Florida subpopulation and the northern subpopulation. Because of its size, the South Florida subpopulation may be critical to the survival of the species in the Atlantic Ocean. In the past, this nesting aggregation was considered second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross 1979, Ehrhart 1989, NMFS and USFWS 1991b). However, the status of the Oman colony has not been evaluated recently and it is located in an area of the world where it is highly vulnerable to disruptive events such as political upheavals, wars, catastrophic oil spills, and lack of strong protections for sea turtles (Meylan et al. 1995). Given the lack of updated information on this population, the status of loggerheads in the Indian Ocean basin overall is essentially unknown.

All loggerhead subpopulations are faced with a multitude of natural and anthropogenic effects that negatively influence the status of the species. Many anthropogenic effects occur as a result of activities outside of United States jurisdiction (i.e., fisheries in international waters).

3.0. Environmental Baseline

By regulation, environmental baselines for biological opinions include the past and present impacts of all state, federal, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impacts of state or private actions which are contemporaneous with the consultation in process. This section contains discussion of the effects of past and ongoing human and natural factors leading to the current status of the species and their habitats within the action area.

The environmental baseline for this opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. The activities that shape the environmental baseline in the action area of this consultation are primarily oil and gas activities, fisheries, discharges, dredging, military activities, and industrial cooling water intake.

3.1. Status of Species in the Action Area

NMFS believes that all sea turtle species are highly migratory throughout the action area. Individual animals may make migrations into nearshore waters as well as other areas of the GOM, Atlantic, and the Caribbean Sea. Therefore, the range-wide status of the five species of sea turtles described in Section 2.0 above most accurately reflects each species' status within the action area. In order to more accurately define the effects of the proposed action on listed species, more defined information is available on listed species in the action area and is summarized below.

3.1.1. Leatherback Sea Turtle

The leatherback is the most abundant sea turtle in waters over the northern GOM continental slope (Mullin and Hoggard 2000). Leatherbacks appear to spatially use both continental shelf and slope habitats in the GOM (Fritts et al. 1983, Collard 1990), but primarily utilize pelagic waters > 200 m (Davis and Fargion 1996) throughout the northern GOM. Recent surveys suggest that the region from the Mississippi Canyon to DeSoto Canyon, especially near the shelf edge, appears to be an important habitat for leatherbacks (Mullin and Hoggard 2000). Surveys of sea turtles in the eastern GOM reported densities of 0.0026 individuals/km^2 (95% CI = 0.0004 - 0.0140) in 0-10 fathoms and 0.0029 individuals/km^2 (95% CI = 0.0015 - 0.0057) in 10-40 fathoms (Epperly et al. 2002). Leatherbacks are year-round inhabitants in the GOM with frequent sightings during both summer and winter (Mullin and Hoggard 2000). Temporal variability and abundance suggest that specific areas may be important to this species, either seasonally or for short periods of time.

3.1.2. Green Sea Turtle

Green sea turtles are found throughout the GOM. They occur in small numbers over seagrass beds along the south of Texas and the Florida GOM coast. Areas known as important feeding areas include the Homosassa River, Crystal River, and Cedar Key, Florida, and seagrass meadows and algae-laden jetties along the Texas coast. Sea turtle surveys in the eastern GOM have reported densities of 0.0021 individuals/km^2 (95% CI = 0.0006 - 0.0075) in 0-10 fathoms and 0.0137 individuals/km^2 (95% CI = 0.0060 - 0.0317) in 10-40 fathoms (Epperly et al. 2002).

3.1.3. Kemp=s Ridley Sea Turtle

The nearshore waters of the GOM are believed to provide important developmental habitat for juvenile Kemp's ridley sea turtles. Ogren (1988) suggests that the GOM coast, from Port Aransas, Texas, through Cedar Key, Florida, represents the primary habitat for subadult ridleys in the northern GOM. This species generally remains within the 50-m isobath of coastal areas

throughout the GOM (Renaud 2001). Surveys of sea turtles in the eastern GOM reported densities of 0.0079 individuals/km^2 (95% CI = 0.0030 - 0.0207) in 0-10 fathoms and 0.0011 individuals/km^2 (95% CI = 0.0004 - 0.0035) in 10-40 fathoms (Epperly et al. 2002). Stomach contents from Kemp's ridleys also indicate a nearshore distribution by their prey distribution which is consistent with other reported density estimates of 0.065 turtles per km^2 in 0-10 fathoms compared to a decrease of 0.013 turtles per km^2 in 10-40 fathoms (Epperly et al. 2002).

3.1.4. Loggerhead Sea Turtle

The nearshore waters of the GOM are believed to provide important developmental habitat for loggerhead sea turtles. Loggerhead nesting along the GOM coast occurs primarily along the Florida Panhandle, although some nesting has been reported from Texas through Alabama as well (NMFS and FWS 1991b). Surveys of sea turtles in the eastern GOM resulted in reported densities of 0.0532 individuals/km^2 (95% CI = 0.0295 - 0.0961) in 0-10 fathoms and 0.0452 individuals/km^2 (95% CI = 0.0233 - 0.0880) in 10-40 fathoms (Epperly et al. 2002). Loggerhead abundance does not appear to be significantly different between winter and summer months over shelf waters in the GOM (Davis et al. 2000b). Although loggerheads are widely distributed during both summer and winter, their abundance in surface waters over the continental slope may be greater during winter than in summer (Mullin and Hoggard 2000), and many sightings occurred near the 100-m isobath (Davis et al. 2000b). Sightings of loggerheads in waters over the continental slope suggest that they may be in transit through these waters to distant foraging sites or seeking warmer waters during the winter. The majority of sightings have occurred in waters over the continental shelf, although many sightings have been reported over the continental slope.

In addition to some distribution over the slope waters, surface sightings of this species have also been made over the outer slope, approaching the 2,000-m isobath. Loggerheads found in deep waters may be traveling to distant nesting beaches, traveling between forage sites on distant and disjunct areas of the continental shelf, or seeking warmer waters during winter (Davis et al. 2000b).

3.2. Federal Actions

In recent years, NMFS has undertaken several ESA section 7 consultations to address the effects of federally-permitted fisheries and other federal actions on threatened and endangered species, and when appropriate, has authorized the incidental taking of listed species. All of the completed consultations sought to develop ways of reducing the probability of adverse effects of these actions on listed species. Similarly, recovery actions undertaken under the ESA are addressing the problem of take of whales, sea turtles, and Gulf sturgeon in the fishing and shipping industries and other activities such as Army Corps of Engineers (COE) dredging operations. The following summary of anticipated sources of incidental take of listed species in the GOM includes only those federal actions that have undergone formal section 7 consultation.

3.2.1. Seismic Survey Activity

The deepwater GOM is the premier source of gas production to offset declines from gas fields on the shelf. Modern 3-D seismic surveys are the main survey method used for these efforts and sometimes cover hundreds of blocks and involve several months of acquisition time (Petzet 1999). The OCS Deep Water Royalty Relief Act (DWRRA*)* provides economic incentives for operators to develop fields in water depths greater than 200 m. About 18% to 47% of the lease blocks in the GOM are undergoing geological surveys in any given year. During GulfCet I and II surveys, seismic exploration signals were detected 10% and 21% of the time, respectively (Davis et al. 2000a). NMFS has determined that minor adverse behavioral effects to sea turtles may result from seismic survey activities in deeper federal waters, but these effects would be short term and minor. Effects to sea turtles have not yet been analyzed in states where nesting beaches and important foraging areas may be present.

3.2.2. Vessel-Related Operations and Exercises

A consultation with the United States Navy (USN) has covered operations out of Mayport, Florida, and the potential for USN vessels to adversely affect large whales and sea turtles has yet to be analyzed for other areas. Similarly, operations of vessels by other federal agencies (e.g., USCG, NOAA, and COE) in the action area have not yet been analyzed for potential effects to listed species; however, effects have been analyzed for vessel traffic authorized under lease sales for the Minerals Management Service (MMS) in the GOM. Through the section 7 process, where applicable, NMFS will continue to establish conservation measures for vessel operations to avoid adverse effects on listed species. The most recent biological opinion with the MMS (NMFS 2003) provides further details on the scope of vessel operations and conservation measures being implemented as standard operating procedures in the GOM.

3.2.3. Dredging

The construction and maintenance of federal navigation channels have also been identified as a source of sea turtle mortality. Hopper dredges move relatively rapidly (compared to sea turtle swimming speeds) and can entrain and kill these species, presumably as the drag arm of the moving dredge overtakes the slower moving animal. Regional biological opinions (RBOs) with the COE have been completed for the southeast Atlantic waters and for the GOM.

Recently, NMFS' section 7 biological opinions on dredging have concluded "no jeopardy" for sea turtles with the implementation of reasonable and prudent measures. The conservation recommendations and reasonable and prudent measures provided in these biological opinions have included avoidance of dredging and disposal in deeper portions of the channel; monitoring and reporting of "take events" during project construction; operation of equipment so as to avoid or minimize take; monitoring of post-project habitat conditions; monitoring of project-area populations; limiting of dredging to the minimum dimensions necessary; limiting the depth of dredged material placed in disposal areas; arrangement of the sequence of areas for dredging to minimize potential harm; screening of intake structures; relocation trawling; and funding of research useful for conservation.

3.2.4. OCS Oil and Gas Activities

Many section 7 consultations have been completed on MMS oil and gas lease activities. Until 2002, these biological opinions concluded that one take of sea turtles may occur annually due to vessel strikes. Biological opinions issued on July 11, 2002 (Lease Sale 184), November 29, 2002 (Multi-Lease Sales 185, 187, 190, 192, 194, 196, 198, 200, 201), and August 30, 2003 (Lease Sales 189 and 197), have concluded that in addition to vessel strikes to sea turtles, adverse effects may occur from seismic surveys and marine debris. NMFS anticipates incidental takes of sea turtles due to marine debris and vessel strikes.

Explosive removal of offshore structures may adversely affect sea turtles. For COE activities, an incidental take (by injury or mortality) of one documented Kemp's ridley, green, hawksbill, leatherback, or loggerhead turtle is anticipated under a rig removal consultation for the New Orleans District (NMFS 1998). MMS activities are anticipated to result in annual incidental take (by injury or mortality) of 30 sea turtles, including no more than 5 Kemp's ridley, green, hawksbill, or leatherback turtles and no more than 10 loggerhead turtles. In July 2004, MMS completed a programmatic environmental assessment (PEA) on geological and geophysical exploration on the GOM Outer Continental Shelf, and is preparing to release a PEA on removal and abandonment of offshore structures and effects on protected species in the GOM.

3.2.5. Fishing

Adverse effects on threatened and endangered species from several types of fishing gear occur in the action area. Gillnet, longline, trawl gear, and pot fisheries have all been documented as interacting with sea turtles. Several formal consultations have been conducted on fisheries that NMFS has determined are likely to adversely affect threatened and endangered sea turtles (e.g., dogfish, southeast shrimp trawl fishery, and Atlantic pelagic swordfish/tuna/shark).

The NRC (1990) reviewed numerous studies and data and determined there was strong evidence that shrimp trawling was the primary agent for sea turtle mortality in the southeastern United States. They estimated that 86% of the human caused mortalities of juvenile and adult sea turtles was caused by shrimp trawling. However, since 1990 the use of TEDs has relieved some of the pressure on sea turtle populations due to shrimp fishing and has contributed to population increases documented for Kemp’s ridley turtles. Kemp’s ridleys are the smallest sea turtle species, and adults can easily pass through the TED opening dimensions. Once the most critically endangered sea turtle, their nesting levels have increased from 700-800 per year in the mid 1980s to over 6,000 nests in 2000. Since 1990, corresponding with the more widespread use of TEDs in United States waters, the total annual mortality as determined by strandings has been reduced by 44% to 50% (Turtle Expert Working Group 2000). We believe this demonstrates the use of TEDs has had a significant beneficial impact on the survival and recovery of sea turtles. On December 2, 2002, NMFS completed consultation and issued a biological opinion for shrimp trawling in the southeastern United States under proposed revisions to the TED regulations. This biological opinion included all of the fisheries listed above in its analysis of the environmental baseline affecting sea turtles. This opinion determined that the shrimp trawl fishery under the revised TED regulations, in combination with the environmental baseline and cumulative impacts, would not jeopardize the continued existence of any sea turtle species. This

determination is based, in part, on the opinion's analysis that shows that the revised TED regulations are expected to reduce shrimp trawl related mortality by 94% for loggerheads and 97% for leatherbacks, and on the fact that even under the previous TED regulations nesting in the southeastern United States for all species of sea turtles (and Rancho Nuevo, Mexico, in the case of Kemp's ridleys), with the exception of the northern nesting population of loggerhead turtles, has been increasing. NMFS (2001) used population models that indicate that the northern nesting population of loggerhead turtles is expected to increase, with a 30% reduction in total mortality.

In addition to new TED requirements, the recent biological opinion on the United States pelagic longline fishery (June 1, 2004) anticipates the following level of annual incidental take in the future (2005 and beyond): 588 leatherbacks per year, 635 loggerheads, and a total of 35 individuals per year of either green, hawksbill, Kemp's ridley, and olive ridley turtles. The implementation of the pelagic longline rule requiring circle hooks and release gear (69 FR 40734) will result in immediate reductions in take and/or mortality for sea turtles. For leatherbacks a minimum 50% reduction rate in take is expected. For loggerheads (and other hardshell turtles) it was conservatively estimated that no reduction in take would occur; however, post-hooking mortality associated with the use of circle hooks instead of J-hooks will be greatly reduced (21.8% vs. 40.4% mortality). By 2007, with full implementation of the rule and the reasonable and prudent alternatives from the biological opinion, the mortality rate of individuals captured is expected to drop further from 21.8% to 17.0% for loggerheads, and from 32.8% to 13.1% for leatherbacks.

3.2.6. ESA Permits

Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for the purposes of scientific research under section 10(a)(1)(a) of the ESA. In addition, the ESA allows for NMFS to enter into cooperative agreements with states developed under section 6 of the ESA, to assist in recovery actions of listed species. Prior to issuance of these authorizations, the proposal must be reviewed for compliance with section 7 of the ESA.

Sea turtles are the focus of research activities authorized by a section 10 permit under the ESA. There are currently 11 active scientific research permits directed toward sea turtles that are applicable to the action area of this opinion. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, blood sampling, tissue sampling (biopsy) and performing laparoscopy on intentionally captured turtles. The number of authorized takes varies widely depending on the research and species involved but may involve the taking of hundreds of turtles annually. Most of takes authorized under these permits are expected to be non-lethal. Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species). In addition, since issuance of the permit is a federal activity, issuance of the permit by NMFS must also be reviewed for compliance with section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species. However, despite these safeguards research activities may result in cumulative effects on sea turtle populations.

3.2.7. Electrical Power Generation

Sea turtles entering coastal or inshore areas have been affected by entrainment in the cooling water systems of electrical generating plants. At the St. Lucie nuclear power plant at Hutchinson Island, Florida, large numbers of green and loggerhead turtles have been captured in the seawater intake canal in the past several years. From 1976 through 2003, all five species of sea turtles have been entrapped in intake canals. A total of 9,452 sea turtles (including recaptures) have been removed from the intake canal at the St. Lucie Plant during this time period. The turtles most frequent numberly taken are loggerheads (57%), followed by greens, Kemp's ridleys, leatherbacks, and hawksbills. Most turtles removed from the intake canal (97%) are released alive to the ocean. NMFS estimates that 1% of the maximum allowable incidental take of 1,000 sea turtles annually (1% of either loggerheads or greens in combination and 2 individual Kemp's ridleys) may be injured or killed as a result of plant operation. Other power plants in Florida, Texas, and North Carolina have also reported low levels of sea turtle entrainment, but formal consultation on these plants' operations has not been completed.

3.2.8. Military Activities

The air space over the GOM is used extensively by the Department of Defense (DoD) for conducting various air-to-air and air-to-surface operations. Nine military warning areas and five water test areas are located within the GOM. The western GOM has four warning areas that are used for military operations. The areas total approximately 21 million acres (ac) or 58% of the area. In addition, six blocks in the western GOM are used by the Navy for mine warfare testing and training. The central GOM has five designated military warning areas that are used for military operations. These areas total approximately 11.8 million ac. Portions of the Eglin Water Test Areas (EWTA) comprise an additional 0.5 million ac in the GOM.

DoD vessel operations and ordnance detonation activities affect listed species of sea turtles. USN aerial bombing training in the ocean off the southeastern United States coast involving drops of live ordnance (500-lb and 1,000-lb bombs) is estimated to have the potential to injure or kill, annually, 84 loggerheads, 12 leatherbacks, and 12 greens or Kemp's ridley, in combination (NMFS 1997). The USN Mine Warfare Center in Corpus Christi, Texas, may take, annually, up to five loggerheads and two leatherbacks, hawksbills, greens, or Kemp's ridleys, in combination, during training activities in the western GOM. United States Air Force operations in the Eglin Gulf Test Range in the eastern GOM may also kill or injure sea turtles. The current level of authorized annual take for the EGTTR issued in 1988 under reconsideration in this opinion is three loggerheads, two leatherbacks, one individual of either a Kemp's ridley, hawksbill, or green sea turtle. Search and rescue training operations are expected to have a low level of impacts, taking two turtles over a 20-year period.

3.3. Private and State Actions

Commercial and recreational traffic and recreational pursuits can have adverse effects on sea turtles and cetaceans through propeller and boat strike damage. Private vessels participate in high speed marine events concentrated in the southeastern United States and are a particular threat to sea turtles, and occasionally to marine mammals as well. The magnitude of the impacts

resulting from marine events has not been quantified, partly due to the difficulty in determining the type of vessel involved, and determining whether the impacts occurred pre- or post-mortem.

3.3.1. Maritime Traffic

Marine transportation in the GOM is expected to grow linearly based on historical freight traffic statistics given the current conditions (MMS 2003). Marine transportation may be affected by channel modifications, port conditions and the number of ports, and the existing shore-based infrastructure. Tanker imports and exports of crude and petroleum products into the GOM are projected to increase. In 2000, approximately 2.08 billion barrels of oil (BBO) (38% of United States total) and 1.09 BBO of petroleum products (13% of United States total) moved through ports in the GOM. By the year 2020, these volumes are projected to grow to 2.79 BBO of crude oil and 1.77 BBO of petroleum products. Crude oil from Alaska, California, and the Atlantic will continue to be transported into the GOM for refining.

For the year 1999, the total number of domestic and foreign trips in the Gulf Intracoastal Waterway equaled 149,414 upbound trips and 148,191 downbound trips; the Alabama harbors, channels, and waterways equaled 47,580 upbound trips and 61,293 downbound trips; the Mississippi harbors, channels, and waterways equaled 10,650 upbound trips and 10,540 downbound trips; the Louisiana harbors, channels, and waterways equaled 351,978 upbound trips and 353,178 downbound trips; and the Texas harbors, channels, and waterways equaled 49,601 upbound trips and 53,123 downbound trips. Crude and petroleum products make up a large portion of the total commodities transported through the action area (MMS 2003).

3.3.2. Commercial Fishing

Various fishing methods used in state fisheries, including trawling, pot fisheries, fly nets, and gillnets are known to cause interactions with sea turtles. Florida has banned all but very small nets in state waters, as has Texas. Louisiana, Mississippi, and Alabama have also placed restrictions on gillnet fisheries within state waters such that very little commercial gillnetting takes place in southeast waters.

The state fishery for menhaden in state waters of Louisiana and Texas is managed with coordination from the Gulf States Marine Fisheries Commission and the level of sea turtle takes, if any, is presently not known. However, the fishery has been classified as a category-II fishery for marine mammal interactions and fishermen are required by the Marine Mammal Protection Act of 1972 to report all interactions with marine mammals. Condrey and Rester (1996) reported a hawksbill take in the fishery and other takes have been reported in the fishery between 1992 and 1999 (DeSilva 1999).

3.3.3. Oil and Gas Activities

State oil and gas exploration, production, and development are expected to result in similar effects to protected species as reported in the analysis of federal activities for oil and gas lease sale biological opinions with the MMS (e.g., NMFS' biological opinion on MMS Lease Sales

189 and 197). A description of these state oil and gas activities occur in Texas, Louisiana, Mississippi, and Alabama is described in detail below.

The Texas coast spans 348 NM. Initially, all coastal states owned 3 miles of land into the GOM; however, with the enactment of the Submerged Lands Act and its interpretation by the Supreme Court in 1960, Texas land extends 3 marine leagues (10.4 mi). The state of Texas has authority over and owns the water, beds, and shores of the GOM, equaling nearly 2.5 million ac. In recent years, oil and gas production in the state of Texas has been declining. From 1978 to 1998 annual crude oil production fell from 1,040,966 Mbbl (million barrels) to 457,499 Mbbl. However, in that same time frame, the number of producing oil wells rose to 170,288. Natural gas production has shown a similar trend over the same period. From 1978 to 1998, Texas natural gas production fell from 7,077.1 tcf to 5,772.1 tcf (trillion cubic feet) and the number of producing gas wells rose from 33,157 to 58,436. Texas offshore oil and gas production for the year 2000 was 41,106 tcf of natural gas and 520,352 bbl of oil. Texas offshore oil and gas production for the year 2001 (as of May 2001) is 18,057 tcf of natural gas and 210,783 bbl of oil (Texas Railroad Commission 2001).

In Louisiana, the Office of Mineral Resources holds regularly scheduled lease sales on the second Wednesday of every month. The first commercial quantities of oil production in Louisiana occurred in 1901, and it marked the beginning of the industry in the state. The first over-water drilling in America occurred in 1910 in Caddo Lake near Shreveport. The state began its offshore history in 1947. The territorial waters of Louisiana extend Gulfward for 2.6 NM and its shoreline extends nearly 304 NM. When including the oil and gas production in the GOM, Louisiana becomes the second leading natural gas producer in the country and the third leading crude oil producer. There are thousands of miles of pipelines in the state carrying crude oil from the GOM to refineries in Louisiana and other states, as well as carrying natural gas throughout the United States (Louisiana Mid-Continent Oil and Gas Association 2001). In 1999, Louisiana offshore production totaled 12.8 Mbbl of crude oil from about 554 offshore oil wells and 147.5 tcf of natural gas from about 177 natural gas wells.

In 1994 the state of Mississippi passed legislation allowing companies to enjoy substantial tax breaks based on the types of discovery involved and the methods they use. Those tax breaks range from a five-year exemption from the state's 6% severance tax for new discoveries to a 50% reduction in the tax for using 3-D technology to locate new oil and gas fields, or using enhanced recovery methods. As a result of the incentive program, 84 new oil pools have received the exemption, 108 inactive wells have been brought back into production, 13 development wells have been drilled in existing fields, 34 enhanced wells have received exemption, and 14 have received exemptions for using 3-D technology (Sheffield 2000).

Alabama state waters extend Gulfward for 3 NM and its shoreline extends 45 NM. The first wells drilled for oil in the southeastern United States were drilled in Lawrence County in 1865, just six years after the first oil well was drilled in the United States. Alabama owns oil, gas, and mineral interests on small upland tracts, submerged river bottoms, estuaries, bays. The Alabama State Oil and Gas Board was created after the oil discovery in 1944. As of August 2001, a total of 69 test wells have been drilled in Alabama coastal waters. Forty of these wells were permitted to test the Norphlet Formation below a depth of 20,000 ft.

The state of Florida has experienced very limited drilling in coastal waters. At present, a moratorium has stopped drilling activity in Florida State waters, which extend 9 NM in the GOM. The state has no plans for lease sales in the future, and no drilling rigs are presently operating within the state.

3.4. Other Potential Sources of Impacts in the Environmental Baseline

A number of activities that may indirectly affect listed species includes discharges from wastewater systems, dredging, ocean dumping and disposal, and aquaculture. The impacts from these activities are difficult to measure. However, conservation actions are being implemented to monitor or study impacts from these sources.

NMFS and the USN have been working cooperatively to establish a policy for monitoring and managing acoustic impacts from anthropogenic sound sources in the marine environment. Acoustic impacts can include temporary or permanent injury, habitat exclusion, habituation, and disruption of normal behavior patterns.

3.4.1. Hypoxia

A large area of the Louisiana continental shelf with seasonally-depleted oxygen levels (< 2mg/l) is caused by eutrophication from both point and non-point sources. Most aquatic species cannot survive at such low oxygen levels and these areas are known as “dead zones.” The oxygen depletion, referred to as hypoxia, begins in late spring, reaches a maximum in mid-summer, and disappears in the fall. After the Mississippi River flood of 1993, the spatial extent of this zone more than doubled in size, to over 18,000 km^2, and has remained about that size each year through mid-summer of 1997. The hypoxic zone has impacts on the animals found there, including sea turtles, and the ecosystem-level impacts continue to be investigated.

3.4.2. Natural Seeps

Naturally occurring hydrocarbon seepage has long been identified as a significant source of hydrocarbons. Tarballs coming from natural seeps were used by early indigenous man living along the GOM coast to construct hunting tools. Given that the GOM is a prolific petroleum-producing province, its seafloor is pocketed with areas from which oil and gas seep. Accurately calculating the volume of naturally seeping oil is problematic. Often the volume measured floating on the surface of the water or beached has been used as the best indicator of the volume originally seeped. For the GOM, a conservative estimate of natural seepage is 140,000 tons/yr. Of that, it is estimated that 57 tons/yr (about 0.04%) (June 6, 2003, industry comments on draft opinion for Lease Sales 189 and 197) are related to OCS platforms.

3.5. Conservation and Recovery Actions Shaping the Environmental Baseline

NMFS has implemented regulations, terms and conditions, and conservation policies aimed at reducing potential incidental take of listed species and promoting their survival and recovery. A summary of these measures is detailed below.

3.5.1. Measures to Minimize Vessel Strikes

In response to a biological opinion issued by NMFS on July 15, 2002, regarding MMS' OCS Lease Sale 184, and the draft opinion on lease sales 189 and 197, MMS issued a Notice to Lessees (NTL No. 2003-G10, Appendix C) regarding vessel avoidance of marine protected species on June 19, 2003. MMS implemented these mitigations for all vessels operating under their jurisdiction throughout the entire GOM.

3.5.2. Measures to Reduce Marine Debris

In addition to existing regulations concerning marine pollution (30 CFR 250.300, Appendix D), MMS issued the Marine Trash and Debris Elimination and Awareness NTL (No. 2003-G11, Appendix E) on June 19, 2003. This NTL requires offshore operators to post placards informing crew of the laws and regulations regarding marine pollution and to train crew on the effects of marine trash and debris on marine animals, effects on commercial and recreational boating interests, and on aesthetic and recreational interests. Although marine debris may be introduced into the marine environment from a variety of sources, MMS and NMFS have partnered to educate offshore workers on how to reduce accidental introduction of marine debris into the environment.

3.5.3. Turtle Excluder Devices

NMFS has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial fisheries. In particular, NMFS has required the use of TEDs in southeastern United States shrimp trawls since 1989 and in summer flounder trawls in the mid Atlantic area (south of Cape Charles, Virginia) since 1992. These regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), floatation, and more widespread use. On April 15, 2003, NMFS required larger escape openings in TEDs used in the southeastern shrimp trawl fishery (68 FR 8456, February 21, 2003). Based upon the analyses in Epperly et al. (2002), leatherback and loggerhead sea turtles will greatly benefit from the new regulations, with expected reductions in mortality (by releasing the sea turtles alive through the TED opening) of 97% and 94% relative to mortality rates under the previous shrimp fishery regulations.

In 1993 (with a final rule implemented in 1995), NMFS established a Leatherback Conservation Zone to restrict shrimp trawl activities from the coast of Cape Canaveral, Florida, to the North Carolina/Virginia border. This provided for short-term closures when high concentrations of migrating leatherbacks were recorded where the shrimp fishery operates. With the implementation of the new TED rule requiring larger opening sizes on all TEDs, the reactive emergency closures within the Leatherback Conservation Zone are no longer necessary since individuals can now fit through the TED opening.

NMFS is also working to develop a TED which can be effectively used in a type of trawl known as a fly net, which is sometimes used in the mid Atlantic and northeastern fisheries to target sciaenids and bluefish. Limited observer data indicate that takes can be quite high in this fishery. A prototype design has been developed, and testing has been underway since December 2002.

Some states also require the use of TEDs to reduce the take of sea turtles in state waters. The states of Texas and Florida presently have TED regulations applicable to shrimp fishing in those state waters.

3.5.4. Miscellaneous Conservation Measures

NMFS has been active in public outreach efforts to educate fishermen regarding sea turtle handling and resuscitation techniques. There is also an extensive network of sea turtle stranding and salvage network participants along the Atlantic and GOM who not only collect data on dead sea turtles, but also rescues and rehabilitates any live stranded turtles.

4.0. Effects of the Action

NMFS considered the potential effects of the various activities on listed sea turtles. The effects analysis considers the projections made by Eglin on the proposed number of tests, detonations, and other information to conduct this analysis. The analysis is based on typical mission activities. This analysis includes the following effects that would result from the proposed action.

- Explosions
- Direct physical impacts
- Marine debris
- Contaminants

The above activities have the potential to harm or harass individual animals and disrupt their habitats, as well as have other effects whose risks to sea turtles are considered in the analysis. NMFS is particularly concerned about disruptions to individuals or populations of endangered species that may manifest as an animal that fails to feed successfully, breed successfully (which can result from feeding failure), or complete its life history because of altered environmental variables or behavioral patterns.

Individual animals have the potential to be affected by the above activities, and are considered below. This analysis includes an examination of the responses at the level of individual animals that could result in population level consequences, such as a reduction in numbers, distribution, or reproduction. In order to calculate the numbers of animals estimated to be incidentally taken by the proposed action, certain variables needed to be taken into consideration, such as the area of the sea affected by PSW activities, the density of animals in the area, the proposed harm avoidance measures (Section 1.4), and the ability to detect and avoid the take of those listed species. NMFS incorporated Eglin=s approach to density estimates in the action area for analyses on pressure waves and noise from exploding ordnance. Density estimates for each species were conservatively adjusted to account for the maximum number of animals that may potentially occur in the ZOI by applying a correction factor for dive profiles (Table 3), and potential takes were calculated from those adjusted densities. All sea turtle density estimates are based on the greatest reported densities in the depth strata between 0-40 fathoms (0-73 meters) in the eastern GOM (Epperly et al. 2002).

Table 3. Sea turtle densities in the eastern Gulf of Mexico and adjusted densities used in the risk analyses for each effect. Adjusted density estimates use a dive profile of 10% of time at surface for each species to account for all animals potentially present in the water column.

Species	Density (individuals km^{-2})	Adjusted Density (individuals km^{-2})
leatherback	0.0029	0.0290
green	0.0137	0.1370
Kemp=s ridley	0.0079	0.0790
loggerhead	0.0532	0.5320

4.1. Explosions

Exploding JASSM and SDB bombs will result in both pressure waves and noise in the marine environment. Impacts to sea turtles will result from exposure to shock waves associated with exploding JASSM and SDBs. Animals close enough to the detonation to be affected by the resulting shock waves could be injured or killed as a result of tissue destruction. Damage is most likely to occur where substantial impedance differences occur (e.g., across air/tissue interfaces in the middle ear, sinuses, lungs, and intestines). The effects of noise on marine animals have been shown to induce hearing impairment and behavioral responses that may disrupt an animal's normal behaviors. The magnitude of any such effects may depend on the characteristics of the sound signal including intensity, frequency, duration, and the depth and direction of the signal, as well as on the auditory and behavioral features of the individual receiving the signal. Although these are important factors, the shock waves produced from NEW of the PSW detonations will be the primary factor that may affect sea turtles.

Background

To determine the effects of large explosions, dual acoustic energy thresholds had been developed for marine mammals for Navy shock trials: an energy threshold and peak pressure threshold. For marine mammals the onset of temporary hearing impairment (temporary threshold shift or TTS) is the criterion for harassment that was used for recent Navy ship shock trials with the USS WINSTON S. CHURCHILL (Department of Defense 2001). However, the ear structure of sea turtles (both an aerial and aquatic receptor, Lenhardt 1996) is different from that of cetaceans, and differences in the effects from the energy from the detonations on marine mammals and marine reptiles may be expected.

The criterion for mortality in the shock trials was the onset of severe lung injury. The threshold was stated in terms of the Goertner (1982) modified impulse model, indexed to a value of 30.5 psi-ms. Since animals of greater mass can withstand greater pressure shock waves, this threshold was conservatively based on the mass of a dolphin calf (12.2 kg) to account for the small-sized cetaceans (Department of Defense 2001). These ranges have also been applied to sea turtles with little supporting documentation to verify its validity. To further determine the Asafe range@ from pressure waves, non-lethal injurious impact (Level A harassment) was defined as 50% eardrum rupture (in cetaceans) which corresponds to approximately 205 dB re $1\Phi Pa^2 \cong s$ (energy flux density or EFD).

At lower energy levels not associated with physical harm, sea turtles may experience TTS or disruption of natural behaviors. In past risk assessments to protected species, the criterion for non-injurious effects of hearing impairment has been the value of the onset of TTS. As stated above there is presently no criterion accepted for sea turtles (for toothed whales it is presently182 db re 1ΦPa^2≅s in any 1/3-octave band above 100 Hz, but the acoustic criteria to determine the effects is presently under revision by NMFS), but marine mammal criterion have occasionally been used in absence of sea turtle data. Because the explosive charges used for the ship shock trials were of large NEWs of 10,000 lb equivalent of TNT, the range of onset of TTS in marine mammals was greater or near the same magnitude for both pressure (12 psi) and energy (182 dB). Although near the same magnitude, the energy criterion was more frequently the determining factor in defining the impact zone radius for the large NEWS used for Navy shock trials, and as a consequence, the 182 dB re 1ΦPa^2≅s has since been commonly used as the criteria for TTS. The determining factor in defining the impact zone radius is based on the net explosive weight. However, as net explosive weights decrease, the difference between the ranges for the onset of TTS for the two criterion becomes greater. The crossover point is approximately 2,000 lb; below this value the pressure criterion will dominate (Dzwilewski and Fenton 2003).

Generally, as the NEW decreases the range for the peak pressure threshold becomes several times greater than the energy threshold, and pressure becomes the dominant effect by having the greater impact zone radius. As a consequence of this effect, shock wave propagation characteristics for smaller NEWS below approximately 2,000 lb using the dual criteria may be greatly underestimated. For purposes of this opinion, the dual criteria used by Eglin are expected to under-estimate the pressure range. Therefore, the dual criteria will be used to characterize possible non-injurious effects from the noise component of the detonations, and shock wave safety ranges will be used to determine distances at which injury is not expected to occur. The analysis below considers pressure as the dominant effect (for mortality, injury, and PTS), and both shock waves and noise disturbance are considered to occur within the safe ranges predicted from the ZOI that are analyzed in this opinion. NMFS has agreed to review and evaluate Eglin's proposed scaling of the 12 psi TTS threshold and its applicability to sea turtles, as well as other possible implications of this scaling effect. Until such an evaluation is complete, pressure will be utilized as the dominant effect for the risk analysis conservative models.

Pressure waves

Several studies have shown that underwater explosions can injure and kill sea turtles (Duronslet et al. 1986, Gitschlag 1990, Gitschlag and Herczeg 1994, Klima et al. 1988, O=Keefe and Young 1984). In March and April of 1986, 51 dead sea turtles, primarily Kemp=s ridleys, washed ashore on Texas beaches after the removal of platforms that involved 22 underwater explosions. Underwater explosions were identified as the probable cause of the strandings (Klima et al. 1988).

NMFS studied the effects of offshore structure removals on sea turtles at various distances of 213.4 m (700 ft), 365.8 m (1,200 ft), 548.6 m (1,800 ft), and 914.4 m (3,000 ft) resulting from a single platform removal using 23 kg (50 lb) of nitromethane (Klima et al. 1988). Using an approximate TNT conversion factor of 1.1 for nitromethane (Department of the Army 1991), 50 lb of this high explosive is equivalent to approximately 55 lb of TNT. The charges were placed

inside platform pilings at a depth of 5 m below the mudline. Placement of charges inside pilings and below the mudline have been shown to decrease the propagation characteristics of the resulting shock wave as compared to an open-water detonation (Dzwilewski and Fenton 2003). Four turtles within 365.8 m (1,200 ft) of the explosion were unconscious as was a loggerhead at 914.4 m (3,000 ft). Sea turtles were expected to have drowned if not recovered from the water following the explosion. All turtles exposed to the blast exhibited everted cloacas and vasodilation lasting 2-3 weeks.

In addition to the placement of charges (e.g., open-water blast, inside a piling, below the mudline, or down a borehole), variations in water depth can strongly affect the propagation of the shock wave produced. Also, the location of the animal in the water column in relation to the depth of charge will affect how an animal may be affected from any given charge weight. For SDB tests, Eglin estimates that all detonations will be in-air from heights of 0 m to 7.6 m (5 ft to 25 ft) above the surface of the water. For JASSM tests, detonations are expected to occur in-water from near the surface at 0.3 m (1 ft depth) to >24.4 m (80 ft) depths. Because the depths cannot be accurately predicted and other sources of propagation into the water column may occur, such as through the CONEX or water barge targets, an open-water propagation equation for underwater explosions (Young 1991, Keevin and Hempen 1997) is used in this analysis to conservatively estimate the number of sea turtles that could potentially be affected by PSW tests. Even though SDB tests are expected to detonate at the surface of the water, the underwater propagation model is used to conservatively account for any shock wave propagation into the water column that could potentially affect individuals.

Based on Young (1991), the following equation may be used to estimate sea turtle safe ranges from underwater explosions:

Impact Zone Radius (ft) = 560 W_E^a, where W_E equals the NEW in pounds, or

Impact Zone Radius (m) = 222 W_E^a, where W_E equals the NEW in kilograms.

Using an equal-energy equation based on the criteria for effects on turtles from underwater explosions (Cavanaugh, pers. comm.), the ZOI for aerial blasts is equivalent to that estimated for the underwater detonations (see Urick 1972 and Young 1991) (Table 4). Following consultation with Eglin concerning the relative impacts of both underwater and aerial explosions on listed species of sea turtles resulting from the proposed action, it was determined that due to the extremely poor transfer of energy from air to water, underwater impacts would be minimal from the aerial detonations from some JASSM and all SDB PWS tests. Due to impedance differences between the two mediums of air and water, the transmission of energy from air to water would be reduced by approximately 1,000-fold across the air-water interface.

Table 4. Impact zone radii for sea turtles for the net explosive weights (NEWs) of ordnance detonated.

Ordnance	NEW (TNT equivalent)		Impact Zone Radius	
	lb	kg	ft	m
JASSM	300	136.10	3748.82	1141.93
Single SDB	48	21.77	2035.17	619.88

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Double SDB	96	43.54	2564.16	781.00

Table 5. The estimated number of sea turtles potentially affected by underwater detonations during PSW testing. Estimates are based the number of animals potentially affected if no harm avoidance measures were implemented (see summary of harm avoidance measures in section 1.4). Numbers in ( ) following each species represent the density estimates for animals potentially affected in the action area (individuals km^{-2}) (see Table 3).

Ordnance	ZOI (km^2)	Total No. of Tests	Number in ZOI/Mission (Number/5 Years)			
			Leatherback (0.029)	**Kemp=s ridley (0.079)**	**Loggerhead (0.532)**	**Green (0.137)**
JASMM	4.0966	5	0.119	0.324	2.179	0.561
5-Year Total			0.594	1.618	10.897	2.806

Table 6. The number of sea turtles potentially affected by aerial detonations during PSW testing. Estimates are based on the number of animals potentially affected if no harm avoidance measures were implemented (see section 1.4). Numbers in ( ) following each species represent the density estimates for animals potentially affected in the action area (individuals km^{-2}) (see Table 3).

Ordnance	ZOI (km^2)	Total No. of Tests	Number in ZOI/Mission (Number/5 Years)			
			Leatherback (0.0029)	**Kemp=s ridley (0.0079)**	**Loggerhead (0.0532)**	**Green (0.0137)**
JASMM	4.0966	5	0.012 (0.059)	0.032 (0.162)	0.218 (1.090)	0.056 (0.281)
Single SDB	1.2072	20	0.003 (0.070)	0.09 (0.191)	0.064 (1.284)	0.016 (0.331)
Double SDB	1.9162	5	0.006 (0.028)	0.015 (0.076)	0.102 (0.510)	0.026 (0.131)
5-Year Total		30	0.157	0.429	2.884	0.743

NMFS has determined that the potential for any effects to sea turtles beneath the surface is so small it is considered insignificant. However, since sea turtles spend a considerable amount of time at or just below the surface of the water, the potential for adverse effects to sea turtles from the aerial pressure wave is considered in this analysis for the aerial detonations at the surface of the water. For detonations occurring beneath the surface, adjusted density estimates were accordingly adjusted to account for all animals that may potentially be affected.

Impact zones calculated represent the safe distance from the detonation at which no injury or mortality will be expected. NEWs are represented in pounds and kilograms and the respective safety zones in feet and meters. There are sparse data on non-lethal damage or delayed mortality to sea turtles resulting from underwater pressure waves and this equation is considered conservative in calculating safe distances using cube root scaling in absence of more definitive data establishing the relationship between the PSW test detonations and safe distances in which no injury is expected for sea turtles.

Sea turtles killed by an explosion will likely suffer lung rupture, which would cause them to float to the surface immediately due to air in the blood stream. Animals that are not killed instantly, but mortally wounded, would likely resurface within a few days, though this would depend on

the size and type of animal, fat stores, depth, and water temperature (DoD 2001). For sea turtles, the risk of damage from ordnance testing can be reduced when observations indicate that there are no sea turtles within the impact area, and by planning mission activities when abundances in the exercise area are expected to be low (e.g., considering seasonal or life history characteristics, *Sargassum* mats, and frontal and/or convergence zones). Aerial monitoring of the area for sea turtles and cetaceans will be conducted and areas where *Sargassum* mats and protected species are sighted will be avoided when approving the final mission location (see section 1.4).

NMFS believes that by doubling the ZOI (referred to as the safety zone) effective monitoring can be accomplished to account for animals outside of the ZOI that may swim into the test area after observations are completed and personnel and resources have moved to a safe distance prior to the PSW tests. The 3.7-km buffer zone for protected species proposed by Eglin is over 1.4 km greater than the largest safety zone we calculated to be required for JASSM (2 x 1,142 m, Table 4). Following the PSW tests, the monitoring team will attempt to document any marine mammals or turtles that were killed or injured as a result of the test and, if practicable, recover and examine any dead animals. The species, number, location, and behavior of any animals observed by the observation teams will also be documented and reported to the lead scientist at Eglin AFB.

In the wild, most adult sea turtles spend at least 3%-6% of their time at the surface for respiration. Despite the brevity of their respiratory phases, sea turtles sometimes spend as much as 26% of their time at the surface, engaged in surface basking, feeding, orientation, and mating (Lutcavage et al. 1997). Sea turtles located in shallower waters have shorter surface intervals, whereas turtles occurring in deeper waters have longer surface intervals. For purposes of adjusting density estimates, sea turtles are assumed to spend 10% of the time at the surface. However, without previous mission data concerning animals detected in ZOI before, during, and after missions, the detection rate of animals is difficult to quantify and must be accounted for to properly assess risk to individuals. Hawksbills, not included in Tables 5 and 6, are not expected to be present in large numbers in the action area, and it is highly unlikely that any takes will result from the proposed action. However, we believe hawksbills should be included in the monitoring and mitigation plan. If hawksbills are sighted, it is recommended that NMFS be contacted to determine if further action is required.

Aerial monitoring is proposed to occur from two helicopters that will survey the safety zone established in this biological opinion. Aerial monitoring will begin two hours prior to the scheduled launch. Observations will begin in the ZOI of the test area for approximately one hour, then proceed outward toward the perimeter of the safety zone to search for any animal that may be on a heading toward the ZOI. Vessel-based observation will be concurrently conducted during this period prior to the launch. Depending on the type of PSW test there will be between 50 and 75 min between the last immediate observation for listed species and the scheduled detonation. The amount of time spent observing the ZOIs and safety zones will be dependent upon the type of PSW test (see Table 10). Due to these differences in observations, NMFS believes that the effectiveness of the mitigations will differ accordingly with the duration of the observations, and the type of PSW test.

There will be a maximum of 75 minutes between the last immediate observation and the

detonation for most PSW tests. Following consultation on Eglin's proposed protected species observer program and the logistics required to conduct the tests, NMFS believes that the proposed sea turtle observations preceding the PSW tests are expected to detect an estimated 30% of the individuals in the area**.** Eglin will use experienced observers that are familiar with the species found on the continental shelf on the GOM and conduct tests in sea surface conditions conducive to effective monitoring for sea turtles and marine mammals (see section 1.4). Even with optimum detection conditions, availability bias and perception bias (Marsh and Sinclair 1989) will likely affect the number of animals sighted in the area monitored. Examples of biases include: diving animals unavailable to be observed; more cryptically colored species such as Kemp's ridleys and greens are more difficult to detect; and observer bias due to glare, sea state, fatigue, and experience level will further affect detection rates. In addition to observation biases, NMFS data indicate that sighting probabilities decrease with distance. While Eglin indicates that aerial observers will have excellent sighting conditions to 1,850 m on either side of the helicopter, data show that even in good observation conditions (Beaufort scale 0-3), sighting probabilities of sea turtles decline rapidly beyond 150 m from the trackline (Epperly et al. 2003).

The degree to which the above biases affect the detection of sea turtles is difficult to predict, but can be reduced by limiting observations to periods of favorable viewing conditions (see section 1.4), adequate training of observers, and frequent rotation of observers to avoid fatigue. In addition to aerial surveys using two helicopters, Eglin has agreed to monitor the area around the PSW test from a vessel. Although vessel-based observations are not expected to be as effective as aerial surveys to detect sea turtles in the entire ZOI, the addition of vessel-based observers is expected to increase detection rates nearest the epicenter of the detonation, but some turtles are expected to be missed from aerial surveys. Without previous mission data to determine sighting rates of sea turtles for PSW tests, NMFS believes the proposed harm avoidance measures will detect 30% of the animals estimated to be in the ZOI during PSW tests (Table 5 and Table 6). As such, the lethal and non-lethal take of the following species may be expected to occur over the five-year test plan:

<u>Aerial Detonations</u>

- two (2.02) loggerheads over five years; and
- one (0.52) green over five years

<u>Underwater Detonations</u>

- one leatherback (0.41) over five years;
- one Kemp's ridley (1.12) over five years;
- eight (7.62) loggerheads over five years; and
- two (1.96) greens over five years

Behavioral Effects of Noise

NMFS' biological opinion on the Eglin Gulf Test and Training Range (NMFS 2004a) found that

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behavioral disturbances to sea turtles were likely to result from noise levels of 175-176 db re 1 ΦPaAs (McCauley et al. 2000a, 2000b, Cavanaugh 2004) resulting from an explosion (see discussion of unit conversions for this data in NMFS 2004a), although the main effects were associated with the pressure waves resulting from exploding ordnance. However, the determination that noise resulting from the EGTTR activities may affect sea turtles analyzed in that opinion differs from the present action under consideration. The duration of the noise emitted from PSW tests is of a much shorter duration (a single detonation per test) than a typical EGTTR test/training mission lasting 10-90 minutes. The firing portion of a typical test/training mission in the EGTTR lasts from 10-90 minutes involving over 100 rounds of live fire each mission. Over 10-90 minute periods of noise exposure to levels of at least 176 db re 1 ΦPaAs, behavioral avoidance of an area lasting hours to days could result in alteration of important biological behaviors or result in sublethal stress to individuals. The potential for significant alteration of behavior described below will not be expected for the short, duration of noise produced from single detonations from PSW tests.

Leatherback, green, Kemp=s ridley, and loggerhead sea turtles could be in areas where the testing and training missions will be conducted. The effects of explosions resulting in non-injurious impacts, such as those resulting in behavioral disturbance or avoidance of the test area, are possible, but are not likely to result in significant adverse effects to sea turtles due to the proposed harm avoidance measures (see section 1.4). Even though the proposed surveys are not expected to detect all individuals during pre-test surveys, the short durations of exposures (seconds) are not expected to result in any significant behavioral disturbances due to noise impacts.

Studies regarding sea turtle hearing indicate that sea turtles are most sensitive to low-frequency sounds and some studies have reported behavioral responses to some sounds (Baker 2000, Bartol et al. 1999, Lenhardt 1994, Lenhardt et al. 1996, McCauley et al. 2000a and 2000b). Some possible reactions to low frequency noise include startle responses and rapid swimming (McCauley 2000a, 2000b), and swimming towards the surface at the onset of the sound, presumably to lessen the effects of the transmissions by utilizing the sound shadow (Lenhardt 1994). The detonation associated with a JASSM or SDB test could possibly result in a startle response by sea turtles, but these responses are likely to be short-term response to exposure of the sound lasting only seconds, and no repeated exposures will occur. Startle reactions may result in increased surfacing, rapid swimming, or diving reactions to an acoustic stimulus, depending on the characteristics of the sound source. As such, due to the short duration of the sounds produced, no significant disturbances to behavior are expected, and the proposed harm avoidance measures (section 1.4) will further reduce the number of individuals that may possibly be exposed, the potential for any non-injurious, adverse effects to behavior as a result of noise are considered insignificant.

4.2. Direct Physical Impacts

Direct physical impact (DPI) is the physical harm that can occur to an animal if it comes into direct contact with an expendable or other mission activity. Collisions with animals (e.g., birds getting hit by an aircraft or sea turtles being struck by watercraft) are examples of DPI. Other examples include wildlife being struck by ordnance or shrapnel. Direct physical impacts could

possibly result from inert bombs and shrapnel from live missiles destroying targets on the surface of the water or in the air. The area in which impacts from falling ordnance or debris will occur is very small (meters across) and can be effectively monitored for species presence. The area of shrapnel is not expected to be greater than the proposed area to be monitored (3.7 km). Live bombs are expected to completely destroy a target, and the proposed monitoring is expected to further reduce any potential risks of injury from shrapnel. The potential for any individuals to be affected by inert bombs in the impact area is so low, it is considered insignificant, and no adverse impacts to listed species of sea turtles are expected from other sources of DPI.

4.3. Marine debris

Debris is the physical material deposited in the waters of the EGTTR during mission activities, analogous to litter, and may affect listed species through entanglement or ingestion. This category differs from chemical materials by focusing on the physical disturbance rather than the chemical alterations that could result from the residual materials. Debris ingestion is an ongoing threat to sea turtles. Although marine activities are subject to regulations prohibiting the disposal of trash into the marine environment, it is expected that items may go overboard accidentally. The vessels are aircraft utilized during the PSW missions are not likely to result in accidental discharges of debris, but marine debris from inert bomb tests dropped on targets or the destruction of targets from live tests is likely to occur.

Sea turtles are often found to be entangled in or to have ingested marine debris, which can result in injury or mortality to the afflicted animal. Materials accidentally lost overboard may be consumed by sea turtles (MMS EA 2002). Sea turtles, especially leatherbacks, may be more susceptible to marine debris ingestion than other species due to the tendency of floating debris to concentrate in convergence zones which adults and juveniles use for feeding areas and migratory routes (Lutcavage et al. 1997, Shoop and Kenney 1992). Sea turtles that mistake plastics for jellyfish may be more vulnerable to gastrointestinal blockage that could result in the mortality of sea turtles. Investigations of the stomach contents of leatherback turtles revealed that a substantial percentage (44% of the 16 cases examined) contained plastic (Mrosovsky 1981). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that these objects may resemble a food item by its shape, color, size, or even movement as it drifts about, and induce a feeding response by foraging animals.

The PSW tests of JASSM and SDB will involve both inert and live deployments. The two possible targets used are made of steel and will introduce little floating debris into the marine environment. Other items such as inert bombs and expended debris are expected to sink and not pose any significant threats to listed species. The PSW tests are expected to contribute very little floating debris into the marine waters. Eglin will make an effort to recover surface debris from the target or the weapons following test activities, to the greatest extent practicable (see section 1.4). Although some items are expected to be unrecovered, many of these items are expected to sink and only small pieces of floating material are expected to be unrecovered, posing little risk of ingestion to sea turtles. These materials are not expected to be ingested or result in entanglement of sea turtles, and no adverse impacts are expected.

4.4. Contaminants and Water Quality

Chemical materials encompass a broad category of liquid, solid, or gaseous substances that are released to the environment as a result of mission activities. These include organic and inorganic materials that can produce a chemical change or toxicological effect to an environmental resource (air or water quality). Examples of chemical materials that may be potentially released into the environment are products from explosive detonations. A detailed analysis of less frequently expended materials that are expected to have minor effects on the marine environment are discussed in the EGTTR environmental assessment (Eglin 2002).

Explosive products

Most explosives used in the EGTTR are composed of TNT, HMX, PBX, or RDX. Aluminum and nitrate compounds are also used in the manufacturing of explosives. These compounds are described in detail in Eglin 2002, and analyzed in NMFS' biological opinion on the EGTTR (2004a). Prolonged exposure (greater than 48 hours) of aquatic vertebrates and invertebrates to these chemicals has produced toxic effects in the form of deformities or abnormalities. The detonation of explosives usually results in the complete combustion of the original material and the emission of carbon dioxide, carbon, carbon monoxide, water, and nitrogen compounds. Any chemicals present will be present in extremely low concentrations and will be quickly dispersed by meteorological factors. Although uncertainties remain on how the existing scientific data on toxicity of these substances to terrestrial mammals apply to marine mammals and sea turtles, these compounds are not expected to persist in the marine environment for periods associated with toxic effects. None of these materials are expected to have any adverse impacts on the marine environment or on listed species.

Summary of effects

The effects of the action associated with live PSW tests (pressure waves and noise) are inherently linked to one another; however, the effects of pressure waves dominate, with the largest ZOI, and are considered as the main effect that can result in a take when the effects are simultaneous. Over the five-year duration of the proposed action involving 35 live PSW tests, exploding bombs are expected to adversely affect sea turtles (Table 6).

Table 7. Summary of the effects of the action that may affect listed species. Take estimates for each effect are estimated over the five-year duration of the PSW plan. For incidental take, decimals ∃ one-third of an animal (>0.33) found in Table 5 have been rounded to the next greatest whole number.

Effect	*Dc*	*Lk*	*Cc*	*Cm*
explosions	1	1	10	3
DPI	0	0	0	0
marine debris	0	0	0	0
contaminants	0	0	0	0

Cc = loggerhead, Dc = leatherback, *Lk* = Kemp=s ridley, *Cm* = Green, *Ei* = hawksbill.

No adverse impacts to listed species are expected to result from DPI resulting from inert or live

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bombs, or shrapnel resulting from exploding bombs or destruction of the targets; changes to water quality; or from impacts associated with marine debris (Table 6).

5.0. Cumulative Effects

Cumulative effects are the effects of future state, local, or private activities that are reasonably certain to occur within the action area considered in this biological opinion (50 CFR 402.02). Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Within the action area, major future changes are not anticipated in ongoing human activities described in the environmental baseline.

NMFS recently completed a section 7 consultation with DoD on the typical test and training missions conducted in the EGTTR. In this opinion, DoD was issued the lethal and non-lethal take of sea turtles for five loggerheads, one leatherback, one Kemp's ridley, and two green sea turtles annually. EGGTR test and training missions are expected to occur indefinitely and may potentially take many sea turtles each decade. Post-event monitoring and reporting should aid in estimating any of the lethal effects associated with these activities. In addition to the expected take level from ongoing activities in the EGTTR, DoD has requested interagency consultation under section 7 of the ESA regarding the Naval Explosive Ordnance School training in the EGTTR for a period of five years. Although the risk of take has yet to be assessed by NMFS, increased use of the EGTTR and use of explosives may affect sea turtles and may possibly result in injury or disrupt habitat utilization and important biological behaviors. DoD expects that additional requests for section 7 consultation, for special training and weapons testing not previously considered, are certain to occur in the future in addition to on-going test and training missions.

The present, major human uses of the action area such as commercial fishing, recreational boating and fishing, military activities, and the exploration, production, and transport of mineral resources, and other waterborne commerce throughout the GOM are expected to continue at the present levels of intensity in the near future as are their associated risks of injury or mortality to listed species.
State-regulated commercial and recreational boating and fishing activities in Gulf waters currently result in the incidental take of threatened and endangered species. It is expected that states will continue to license/permit large vessel and thrill-craft operations that do not fall under the purview of a federal agency and will issue regulations that will affect fishery activities. Any increase in recreational vessel activity in inshore and offshore waters of the GOM, increase the risk of turtles taken by injury or mortality in vessel collisions. Additionally, waterborne commerce is expected to increase throughout the GOM that will increase ambient noise levels, and pose increased risks of vessel collisions with protected species.

Coastal runoff and river discharges carry large volumes of petrochemical and other contaminants from agricultural activities, cities, and industries into the GOM. A variety of diseases occur in marine turtles from different pathogens, harmful algal blooms, and increased contaminant loads in marine animals. Diseases in turtles appear to occur more frequently in turtles that reside in

poorly circulating, near-shore waters close to large human populations. Indeed, the coastal waters of the GOM have more sites with high contaminant concentrations than other areas of the coastal United States, due to the large number of waste discharge point sources. The listed species analyzed in this opinion may be exposed to these contaminants, and as a direct or indirect consequence, accumulate, and be at an increased risk of disease and mortality during their life cycles.

Beachfront development, lighting, and beach erosion control are all ongoing activities along the southeast United States. coastline. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, more and more coastal counties have or are adopting more stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting. Some of these measures were drafted in response to law suits brought against the counties by concerned citizens who charged the counties with failing to uphold the ESA by allowing unregulated beach lighting which results in takes of hatchlings.

Recreational hook-and-line fisheries have been known to lethally take sea turtles. Future cooperation between NMFS and the states on these issues should help decrease take of sea turtles caused by recreational activities. NMFS will continue to work with states to develop ESA section 6 agreements and section 10 permits to enhance programs to quantify and mitigate these takes.

The level of authorized incidental take in the GOM is expected to continue to increase in the future. Increased pressures from coastal development, pollution, noise, recreational and commercial fisheries, marine transportation, and mineral resource exploration and development is expected to result in increased risks to listed species and the ecosystems on which they depend. Although some unavoidable take is anticipated from present and future actions, harm avoidance measures are expected to reduce or eliminate takes many of the takes that may be associated with these actions. NMFS expects that the in consideration of the present level of take authorized in the GOM, the level of take expected from proposed action will increase the level of take expected for endangered and threatened leatherback, Kemp=s ridley, loggerhead, and green sea turtles species in the GOM.

6.0. Jeopardy Analysis: Effect of Action on Likelihood of Survival and Recovery

The analyses conducted in the previous sections of this opinion serve to provide a basis to determine whether the proposed action would be likely to jeopardize the continued existence of ESA listed sea turtles. In Section 5 we have outlined how the effects of the PSW test missions can affect sea turtles, and the extent of those effects in terms of five-year estimates of numbers of turtles injured or killed. Now we turn to an assessment of the species' response to this impact, in terms of overall population effects from the estimated take, and whether those impacts would appreciably reduce the species' likelihood of surviving and recovering in the wild, thereby jeopardizing the continued existence of the species.

In 2001, NMFS (SEFSC) issued a stock assessment of loggerhead and leatherback sea turtles that had population assessments for these turtles in the Atlantic (NMFS 2001). These analyses included estimates of the nesting abundance and trends, estimation of vital rates, population modeling and projections of population status under various scenarios for loggerheads (there was insufficient data for leatherback modeling), evaluation of genetic relationships between populations, assessment of the impact of the pelagic longline fishery on leatherbacks and loggerheads, and evaluation of available data on other anthropogenic effects on these populations. This document built upon the modeling and analysis presented in the Heppell et al. (2003) chapter in Bolten and Witherington (2003), which was in press at the time NMFS SEFSC 2001 was published. The chapter contained a review of loggerhead population modeling and updated the modeling technique with new information compared to those previously used by Frazer, Crouse, Crowder, and Heppell. Additionally, the SEFSC document reviews the scientific literature on previous evaluations of status, trends, and biological parameters of Atlantic loggerheads and leatherbacks. NMFS assessment (NMFS SEFSC 2001) was reviewed by three independent experts (Center for Independent Experts). As a result, NMFS' stock assessment report, the reviews of it, and the body of scientific literature upon which these documents were derived represent the best available scientific and commercial information for the Atlantic and provide further analysis for the jeopardy determinations in this opinion.

Both adult and juvenile stages may be taken by the proposed action. All life stages are important to the survival and recovery of the species; however, it is important to note that individuals of one life stage are not equivalent to those of other life stages. For example, the take of male juveniles may affect survivorship and recruitment rates into the reproductive population in any given year, and yet not significantly reduce the reproductive potential of the population. However, the death of mature breeding females can have an immediate effect on the reproductive rate of the species. Sub-lethal effects on adult females may also reduce reproduction by hindering foraging success, as sufficient energy reserves are probably necessary for producing multiple clutches of eggs in a breeding year. Different age classes may be subject to relative rates of mortality, resilience, and overall effects of population dynamics. In the absence of information on absolute numbers and sex ratio of the various age classes, it is difficult to predict the anticipated annual mortality of different age classes from the proposed action; however, even assuming they all would be lethal, the relatively low numbers of takes over five years (one leatherback, one Kemp's ridley, ten loggerheads, and three greens) are not expected to appreciably reduce the numbers found in any given age class, and not all of the expected takes will affect reproduction or recruitment into the population. Because of the expected low number of interactions with the species under consideration, we believe that the effects of the proposed action are not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival and recovery of leatherback, Kemp's ridley, loggerhead, or green sea turtles in the wild.

Summary

Based upon our review of the best available information, including the effects of the proposed action, the status of the species, and cumulative effects, although the proposed action may result in the loss of a few individuals of each affected sea turtle species over the next five years, we believe that the proposed action *is not* likely to reduce appreciably the likelihood of the survival

and recovery of leatherback, Kemp's ridley, loggerhead, green, or hawksbill sea turtles in the wild.

7.0. Conclusion

NMFS believes that the effects of the proposed action, the lethal or non-lethal take of up to one leatherback, one Kemp=s ridley, ten loggerheads, and three green sea turtles by pressure waves over the five-year lifetime of the proposed action are not likely to appreciably reduce either the survival or recovery of leatherback, Kemp=s ridley, loggerhead, green, or hawksbill sea turtles in the wild.

After reviewing the status of endangered and threatened sea turtles, the environmental baseline, the effects of the proposed action, and the cumulative effects, it is the biological opinion of NMFS that implementation of the proposed action described in this opinion is not likely to jeopardize the continued existence of these species.

8.0. Incidental Take Statement

Section 9 of the ESA and federal regulations promulgated pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to and not intended as part of a federal agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of an incidental take statement.

The measures described below are non-discretionary and must be undertaken by Eglin for the exemption in section 7(o)(2) to apply. Eglin has a continuing duty to regulate the activity covered by this incidental take statement. If Eglin fails to assume and/or require implementation of the terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Eglin must report or require reporting of the progress of the action and its impact on the species to NMFS as specified in the incidental take statement.

8.1. Amount or Extent of Anticipated Take

NMFS has determined that there is an expected impact to sea turtles in the action area as a result of explosions associated with the PSW tests. The proposed harm avoidance requirements in section 1.4 will reduce the total number of potential sea turtle takes by 30%, however, some unavoidable impacts to sea turtles are expected from the proposed action. Therefore, pursuant to section 7(b)(4) of the ESA, NMFS anticipates incidental take over the five-year PSW Test plan as follows:

<u>Explosions</u>

- One lethal or non-lethal take of a leatherback sea turtle over five years
- One lethal or non-lethal take of a Kemp's ridley sea turtle over five years
- Ten lethal or non-lethal takes of loggerhead sea turtles over five years
- Three lethal or non-lethal takes of green sea turtles over five years

If the actual incidental take exceeds this level over five years, Eglin Air Force Base must immediately reinitiate formal consultation.

8.2. Effect of the Take

In the accompanying biological opinion, NMFS determined that the aforementioned level of anticipated take is not likely to appreciably reduce the survival and recovery of leatherback, green, Kemp=s ridley, or loggerhead sea turtles in the wild. In particular, NMFS does not expect activities associated with the proposed action, when added to ongoing activities affecting these species in the action area and cumulative effects, to affect these listed species in a way that measurably or significantly reduces the number of animals born in a particular year (i.e., a specific age-class), the reproductive success of adults, or the number of young that annually recruit into a adult breeding population. The proposed action, therefore, is not likely to result in jeopardy to any of the above-mentioned species.

8.3. Reasonable and Prudent Measures

1. Eglin AFB shall monitor an appropriately protective zone of influence (no less than two times the zones of impact given in Table 4).

2. Eglin AFB shall implement monitoring and reporting measures to validate the effectiveness of the measures to reduce impacts to sea turtles resulting from the test and training missions in the Eglin Gulf Test and Training Range.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, Eglin must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting and monitoring requirements. These terms and conditions are non-discretionary.

Reporting of Monitoring of PSW Tests

Eglin shall submit a report to the NMFS= Southeast Regional Office no later than 30 days following each live PSW test, containing the following information:

a. For all live PSW tests, include the survey plan information for Reasonable and Prudent Measure no. 1 above.

b. For all live PSW tests involving detonations, provide the date, time frame, and description of each PSW mission (the type of PSW and NEW used in the test).

b. The coordinates and water depth of each mission location.

c. The time pre-mission clearance of the area began and ended, identification of turtles sighted (to species level if possible), and number sighted.

d. Provide a summary of the environmental conditions of each survey (e.g., sea state, meterological conditions, presence/absence of *Sargassum*, etc.)

e. Whether a new test location was chosen and the coordinates and water depth of the new location. Provide the circumstances surrounding the relocation of the test location.

f. Report the time the detonation occurred for each PSW test.

g. For each PSW test report, indicate the times observations were initiated and completed for each of the aerial and shipboard monitoring intended to locate and identify dead or injured animals, or those exhibiting unnatural behaviors. Any dead or injured species sighted should be identified and collected in coordination with the sea turtle stranding network. Eglin shall assist the sea turtle stranding network representatives in any recovery activities as needed. For unrecoverable animals, a description of any floating or possibly injured species should be immediately reported to the Southeast Regional Office.

Any unauthorized take of listed species not listed above shall also be immediately reported to the NMFS representative of the sea turtle stranding network, and such take would require reinitiation of a new consultation by Department of the Air Force.

The Sea Turtle Stranding and Salvage Network: (305) 361-4478

9.0. Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to utilize their authority to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

- Hawksbills are not expected to be present in the habitat characteristics associated with action area, and it is highly unlikely that any takes will result from the proposed action. However, it is recommended hawksbills should be included in the monitoring and mitigation plan. Any observations of hawksbills should be documented and reported to NMFS to determine if reinitiation of interagency consultation on this action required.

- Due to the high level of testing and training activities in the Eglin Gulf Test and Training Range, Eglin AFB should sponsor research programs to study the abundance, habitat use, and seasonal movement of threatened and endangered species and marine mammals in waters off the coast of the Florida Panhandle. It is recommended that Eglin AFB

continue to sponsor monitoring efforts for sea turtle nesting and hatching success trends in the region. Research is recommended on identifying and characterizing juvenile foraging habitats, and tracking movements of different age classes between these habitats.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

10.0. Reinitiation of Consultation

This concludes formal consultation on DoD's Precision Strike Weapons tests and associated activities conducted by the Eglin Air Force Base. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) the amount or extent of the taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered, (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the opinion, or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, Eglin must immediately request reinitiation of formal consultation. Military activities conducted within the EGTTR that are not planned by Eglin Air Force Base are not considered in this opinion and may require a separate section 7 consultation under the ESA.

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JUL 28 2005

Mr. Stephen M. Seiber
Chief, Natural Resources Branch
AAC/EMSN
501 DeLeon Street, Suite 101
Eglin Air Force Base, Florida 32542-5133

Dear Mr. Seiber:

Enclosed is an Incidental Harassment Authorization (IHA) issued to Eglin Air Force Base (Eglin AFB), pursuant to Section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1361 et seq.), to take, by harassment, marine mammals incidental to conducting Precision Strike Weapons testing in Eglin AFB's Gulf Test and Training Range. Eglin AFB is required to comply with the conditions contained in the IHA. In addition, Eglin AFB must cooperate with any Federal, state, or local agency monitoring the impacts of your activities, and submit a draft report to the National Marine Fisheries Service's (NOAA Fisheries) Office of Protected Resources, within 90 days after completion of the work authorized herein. Along with other mitigation measures to be incorporated, the IHA requires monitoring for the presence and behavior of marine mammals.

If you have any questions concerning the IHA or its requirements, please contact Ken Hollingshead, NOAA Fisheries, Office of Protected Resources, at (301) 713-2289, ext. 128.

Sincerely,

James H. Lecky
Director
Office of Protected Resources

Enclosure

DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

Incidental Harassment Authorization

The Commanding Officer, Eglin Air Force Base, FL 32542-5133 is hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1371(a)(5)(D)) and 50 CFR 216.107 to harass a small number of marine mammals incidental to conducting precision-strike weapons testing within the Eglin Gulf Test and Training Range (EGTTR), contingent upon the following conditions:

1. This Authorization is valid from July 28, 2005 through July 27, 2006.

2. This Authorization is valid only for activities associated with (a) the Joint Air-to-Surface Stand-off Missile (JASSM) exercise for a maximum of two live shots (single) and 4 inert shots (single) and (b) the small-diameter bomb (SDB) exercise for a maximum of six live shots a year, with two of the shots occurring simultaneously and a maximum of 12 inert shots with up to two occurring simultaneously, as specified in Eglin AFB's February 4, 2004, request.

3. The taking, by incidental harassment only, is limited to Atlantic bottlenose dolphins (*Tursiops truncatus*), Atlantic spotted dolphins (*Stenella frontalis*), dwarf sperm whales (*Kogia simus*) and pygmy sperm whale (*Kogia breviceps*). The taking by injury or death of these species, the taking of these species in violation of the conditions of this Incidental Harassment Authorization, or the taking by harassment, injury or death of any other species of marine mammal is prohibited and may result in the modification, suspension or revocation of this Authorization.

4. Mitigation.

a. Under this Authorization, the following safety and buffer zones are required to be established for marine mammals: JASSM SAFETY ZONE = 2.0 nm/3.7 km radius; BUFFER ZONE = 1.0 nm/1.85 km radius outside the safety zone. SDB SAFETY ZONE = 5-10 nm/9.3-18.5 km; BUFFER ZONE=2.5 - 5 nm/4.6 -18.5 km.

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b. The detonation of explosives under this Authorization must be conducted in a manner that minimizes, to the greatest extent possible, adverse impacts on marine mammals and their habitat. When detonating explosives, the following mitigation measures must be utilized:

(i) If one or more marine mammals or sea turtles are observed within the designated safety zone prescribed above, or within the buffer zone on a course that will put them within the safety zone prior to JASSM or SDB launch, the launching must be delayed until all marine mammals and sea turtles are no longer within the designated safety zone.

(ii) If one or more marine mammals is detected in the buffer zone and subsequently cannot be reacquired, the mission launch will not continue until the next verified location is outside of the safety zone and the animal is moving away from the mission area.

(iii) If large *Sargassum* rafts or large concentrations of jellyfish are observed within the safety zone, the mission launch will not continue until the *Sargassum* rafts or jellyfish that caused the postponement are confirmed to be outside of the safety zone due to the current and/or wind moving them out of the mission area.

(iv) If weather and/or sea conditions preclude adequate aerial surveillance for detecting marine mammals and other marine life, detonation must be delayed until adequate sea conditions exist for aerial surveillance to be undertaken. Adequate sea conditions means the sea state does not exceed Beaufort sea state 3.5 (i.e., whitecaps on 33 to 50 percent of surface; 0.6 m (2 ft) to 0.9 m (3 ft) waves), the visibility is 5.6 km (3 nm) or greater, and the ceiling is 305 m (1,000 ft) or greater.

(v) To ensure adequate daylight for pre- and post-detonation monitoring, mission launches may not take place earlier than 2 hours after sunrise, and detonations no later than 2 hours prior to sunset, or whenever darkness or weather conditions will preclude completion of the post-test survey effort described in condition 5 below.

(vi) If post-detonation surveys determine that a serious injury or lethal take of a marine mammal has occurred, the test procedure and the monitoring methods must be reviewed with the National Marine Fisheries Service and appropriate changes must be made, prior to conducting the next mission detonation.

(vii) Mission launches will be delayed if aerial or vessel monitoring programs described under condition 5 of this Authorization cannot be fully carried out.

5. Monitoring.

(a). The holder of this Letter of Authorization is required to cooperate with the National Marine Fisheries Service and any other Federal, state or local agency monitoring the impacts of

the activity on marine mammals. The holder must notify the Protected Species Office, Southeast Region, National Marine Fisheries Service, (Telephone: (727) 570-5312), at least 2 weeks prior to mission launches.

(b) The holder of this Authorization must designate qualified on-site individual(s) to record the effects of mission launches on marine mammals that inhabit the northern Gulf of Mexico.

(c) The holder of this Authorization will train personnel to conduct aerial surveys for protected species and complete an aerial survey before each mission. The aerial survey/monitoring team will consist of two experienced marine mammal observers, approved in advance by the Southeast Region, NMFS. The aircraft will also have a data recorder who would be responsible for relaying the location, the species if possible, the direction of movement, and the number of animals sighted.

(d). The holder of this Authorization will conduct shipboard monitoring to reduce impacts to protected species. Trained observers, approved in advance by the Southeast Region, NMFS will conduct monitoring from the highest point possible on a mission ship. The observer on the vessel must be equipped with optical equipment with sufficient magnification (e.g., 25X power "Big-Eye" binoculars.

(e). The aerial and shipboard monitoring teams will maintain proper lines of communication to avoid communication deficiencies. The observers from the aerial team and operations vessel will have direct communication with the lead scientist aboard the operations vessel.

(f).Pre-mission Monitoring: Approximately 5 hours prior to the mission, or at daybreak, the appropriate vessel(s) would be on-site in the primary test site near the location of the earliest planned mission point. Observers onboard the vessel will assess the suitability of the test site, based on visual observation of marine mammals and sea turtles, the presence of large Sargassum mats, and overall environmental conditions (visibility, sea state, etc.). This information will be relayed to the lead scientist.

(g). Two Hours Prior to Mission:

(i) Two hours prior to the mission, aerial monitoring would commence within the test site to evaluate the test site for environmental suitability. Evaluation of the entire test site would take approximately 1 to 1.5 hours. The aerial monitoring team would begin monitoring the safety zone and buffer zone around the target area.

(ii) Shipboard observers would monitor the safety and buffer zone, and the lead scientist would enter all marine mammals and sea turtle sightings, including the time of sighting and the direction of travel, into a marine animal tracking and sighting database.

(h) One to 1.5 Hours Prior to Launch:

(i) Depending upon the mission, aerial and shipboard viewers would be instructed to leave the area and remain outside the safety area. The aerial team would report all marine animals spotted and their directions of travel to the lead scientist onboard the vessel.

(ii) The shipboard monitoring team would continue searching the buffer zone for protected species as it leaves the safety zone. The surface vessels will continue to monitor from outside of the safety area until after impact.

(i) Post-mission monitoring:

(i) The vessels will move into the safety zone from outside the safety zone and continue monitoring for at least two hours, concentrating on the area down current of the test site.

(ii) The holder of this Authorization will closely coordinate mission launches with marine animal stranding networks.

(iii) The monitoring team will document any marine mammals or turtles that were killed or injured as a result of the test and, if practicable, recover and examine any dead animals.

(j) Activities related to the monitoring described in this Letter of Authorization may include the retention of marine mammals without the need for a separate scientific research permit.

6. Reporting.

(a) A draft report must be submitted to the Assistant Administrator for Fisheries, NOAA, within 120 days after the conclusion of the last planned mission launch under this authorization. This report must include the following information:

(i) Date and time of each mission launch and detonation;

(ii) A complete description of the pre-test and post-test activities related to mitigating and monitoring the effects of explosives detonation on marine mammal populations; and

(iii) Results of the monitoring program, including numbers by species/stock of any marine mammals noted injured or killed as a result of the detonations and numbers that may have been harassed due to presence within the safety zone.

(b) The draft report will be subject to review and comment by the National Marine Fisheries Service. Any recommendations made by the National Marine Fisheries Service must be addressed in the final report prior to acceptance by the National Marine Fisheries Service. The draft report will be considered the final report for this activity under this Authorization if the National Marine Fisheries Service has not provided comments and recommendations within 90 days of receipt of the draft report.

7. Additional Conditions:

(a) Activities related to the monitoring described in this Authorization do not require a separate scientific research permit issued under section 104 of the Marine Mammal Protection Act.

(b) The holder of this Authorization must inform the Assistant Administrator for Fisheries, NOAA, prior to the initiation of any changes to the monitoring plan for a specified mission launch.

(c) A copy of this Authorization must be in the possession of each ship or aircraft operating under the authority of this Letter of Authorization.

(d) The holder of this Authorization is required to fully implement the Terms and Conditions contained in the Biological Opinion issued by the National Marine Fisheries Service for this activity.

James H. Lecky
Director
Office of Protected Resources
National Marine Fisheries Service

7/28/05
Date

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APPENDIX C

PROTECTED SPECIES DESCRIPTIONS

PROTECTED SPECIES DESCRIPTIONS

Baleen Whales

Bryde's whales (*Balaenoptera edeni*) can attain a length of up to 46 feet. Their distribution ranges in the Atlantic from Virginia to the southeast Caribbean, including the northern and eastern Gulf of Mexico (Caldwell and Caldwell, 1983). They are the only regularly occurring baleen whales in the Gulf of Mexico. In addition to filter feeding, Bryde's whales may also feed directly on small schools of fish such as anchovies. Most sightings of the Bryde's whale have occurred during the spring and summer months along the continental shelf edge (Davis et al., 2000).

Toothed Whales and Dolphins

Atlantic bottlenose dolphins (*Tursiops truncatus*) occur in slope, shelf, and inshore waters of the Gulf. The average herd or group size of Atlantic bottlenose dolphins in shelf and slope waters was approximately 4 and 10 individuals, respectively, per herd as determined by GulfCet II surveys of eastern Gulf waters (Davis et al., 2000). The diet of Atlantic bottlenose dolphins consists mainly of fish, crabs, squid, and shrimp (Caldwell and Caldwell, 1983).

Atlantic spotted dolphins (*Stenella frontalis*) can attain lengths of up to 8 feet at adulthood. Their distribution in the Atlantic ranges from the latitude of Cape May, New Jersey, along mainland shores to Venezuela, including the Gulf of Mexico and Lesser Antilles (Caldwell and Caldwell, 1983). The diet of the Atlantic spotted dolphin consists of squid and fish.

Blainville's beaked whales (*Mesoplodon densirostris*) may attain lengths of up to 17 feet. Limited to the warm temperate and tropical waters of the world, their distribution in the Atlantic ranges from Nova Scotia to Florida, the Bahamas, and the northern Gulf of Mexico (GOM). General information on the Mesoplodon family of GOM species of beaked whales (Blainville's, Gervais, and Sowerby's) describes these animals as deep-diving, feeding mainly on fish, squid, and deep-water benthic (bottom) invertebrates. Blainville's beaked whales are difficult to distinguish from other beaked whales during surveys, but beaked whales in general were sighted in all seasons during the GulfCet II surveys of the northern GOM (Davis et al., 2000).

Clymene dolphins (*Stenella clymene*) can attain lengths of up to 6.5 feet at adulthood. This species has been primarily sighted in deep waters and feeds mostly on mesopelagic fish and squid. The Clymene dolphin is a recently recognized species, having been designated in 1981.

Cuvier's beaked whales (*Ziphius cavirostris*) are known to attain a maximum size of 24 feet, 9 inches. Their distribution in the Atlantic ranges from Massachusetts to the West Indies, including the Gulf of Mexico (Caldwell and Caldwell, 1983). Diet consists of squid and deepwater fishes (Caldwell and Caldwell, 1983). Perhaps the most common beaked whale in the Gulf, these animals have been sighted in all seasons during the GulfCet II surveys of the northern GOM (Davis et al., 2000).

Dwarf sperm whales and pygmy sperm whales. Dwarf sperm whales (*Kogia simus*) commonly inhabit the deeper offshore water, generally eating squid, crustaceans, and fish (Caldwell and Caldwell, 1983), but they do move into inshore waters during calving season. The pygmy sperm

whale (*Kogia breviceps*) has a diet similar to that of the dwarf sperm whale. Both pygmy and dwarf sperm whales have been sighted in the northern Gulf of Mexico, primarily along the continental shelf edge and in deeper shelf waters during all seasons except winter (Mullin et al., 1994). Dwarf and pygmy sperm whales have a high percentage of strandings relative to percent population of all cetaceans (Mullin et al., 1994). Pygmy and dwarf sperm whale Gulf of Mexico stocks are not considered strategic.

False killer whales (*Pseudorca crassidens*) can reach 19 feet in length at adulthood. Their distribution in the Atlantic ranges from Maryland to Venezuela, including the eastern and northwestern Gulf of Mexico. Squid and fish are the primary prey (Thurman, 1993). False killer whales were seen in the spring and summer during the GulfCet II surveys of the northern GOM (Davis et al., 2000).

Fraser's dolphins (*Lagenodelphis hosei*) are estimated at adulthood to weigh between 330 and 460 pounds. No information on length was available. This species is tropical in distribution and should be expected in pelagic waters of all oceans. Diet consists of squid, crustaceans, and deep-sea fish. This species has been sighted in the northern GOM in deeper water off of the continental shelf (Mullin et al., 1994, Leatherwood et al., 1993).

Gervais' beaked whales (*Mesoplodon europaeus*) are relatively unknown with little specific information available on size, distribution, or feeding habits. Beaked whales generally range from 13 to 43 feet in length. Generally Mesoplodon beaked whales (Blainville's, Gervais, and Sowerby's) are deep-diving, feeding mainly on fish, squid, and deep-water benthic (bottom) invertebrates. Life history descriptions of beaked whales are limited. Occurrences of beaked whales are typically alone or in pairs, and they are often seen covered with circular markings (scratches). Beaked whales have been seen during all seasons of GulfCet II surveys (Davis et al., 2000).

Killer whales (*Orcinus orca*) are the largest of the dolphin family, attaining lengths to 32 feet. Killer whales are found in all oceans of the world, with local distribution ranging from the Atlantic pack ice to the Lesser Antilles, including the northern, eastern, and western portions of the GOM. Their primary diet consists of fish, squid, sea turtles, sea birds, and other marine mammals. Sightings of killer whales during the GulfCet II surveys occurred only during the spring in the north-central Gulf (Davis et al., 2000).

Melon-headed whales (*Peponocephala electra*) are generally described as medium sized. Their distribution is worldwide from tropical to warm-temperate waters including the Atlantic Ocean and Gulf of Mexico. Their diet consists of squid and small fish. Melon-headed whales were sighted in the GOM during the 1992-1993 marine mammal assessment survey by the NOAA Southwest Fisheries Science Center (SWFSC) and Texas A&M University.

Pantropical spotted dolphins (*Stenella attenuata*) are abundant in tropical oceans and are commonly observed over the continental slope and deep pelagic areas of the Gulf of Mexico. Squid and a variety of schooling fish comprise their diet.

Pygmy killer whales (*Feresa attenuata*) may attain lengths up to 9 feet at adulthood. Their distribution in the Atlantic ranges from North Carolina to the Lesser Antilles, including the Gulf of Mexico. Their diet consists of squid and fish (Thurman, 1993).

Risso's dolphins (*Grampus griseus*) may attain lengths of up to 13 feet upon reaching adulthood. Distribution in the Atlantic ranges from eastern Newfoundland to the Lesser Antilles, including northern and eastern Gulf of Mexico waters. Prey items are primarily squid and some fishes. Sightings in the Gulf occur along the continental shelf and slope.

Rough-toothed dolphins (*Steno bredanensis*) reach sizes up to 8 feet at adulthood. The Atlantic distribution of this species includes waters from Virginia to northeastern South America, including the eastern and northwestern Gulf of Mexico. Squid and octopi are the primary prey items. Rough-toothed dolphins are expected to occur throughout the year in the GOM (Jefferson et al., 1992; Minerals Management Service, 1990). Sightings of this species were recorded in the eastern Gulf in the spring and summer during the GulfCet II surveys (Davis et al., 2000).

Short-finned pilot whales (*Globicephalus sp.*) can attain lengths of up to 23 feet. Their distribution in the Atlantic ranges from New Jersey to Venezuela, including Gulf of Mexico (Caldwell and Caldwell, 1983). This species feeds on squid and fishes. Short-finned pilot whales are more commonly observed in the western and central Gulf than in the eastern Gulf. Sightings of short-finned pilot whales occurred in the spring and winter in the oceanic northern Gulf during the GulfCet II survey (Davis et al., 2000).

Sperm Whales (*Physeter macrocephalus*) are the most abundant of the federally endangered whales in the GOM and may attain lengths of up to 69 feet at adulthood (Jefferson et al., 1992; Caldwell and Caldwell, 1983). Their distribution in the Atlantic ranges from Davis Straits to Venezuela (Caldwell and Caldwell, 1983). Sperm whales can be found along the continental slope and shelf break, as well as near seamounts and submarine ridges, feeding on fish and squid. These animals have been sighted in the GOM during all seasons, and areas of relatively high occurrence have been noted near the Mississippi River delta (Davis et al., 2000).

Spinner dolphins (*Stenella longirostris*) are found in tropical and subtropical waters worldwide, and can attain lengths of up to 7 feet at adulthood. This species typically occurs in deep water. Spinner dolphins feed primarily on mesopelagic fish and squid.

Striped dolphins (*Stenella coeruleoalba*) are distributed worldwide in tropical to temperate waters and may attain lengths of up to 9 feet. The striped dolphin is an oceanic species. Feeding occurs at mid-depths on fishes, squid, and crustaceans.

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APPENDIX D

SUPPORTING NOISE ANALYSIS INFORMATION

SUPPORTING NOISE ANALYSIS INFORMATION

Metrics

Four standard acoustic metrics were used for the analysis of underwater pressure waves in this document.

- *Energy Flux Density (EFD).* Energy flux density (EFD) is the time integral of the squared pressure divided by the impedance. EFD levels have units of dB re 1 μPa^2-s.
- *1/3-Octave EFD.* This is the energy flux density in a 1/3-octave frequency band; the 1/3 octave selected is the hearing range at which the subject animal's hearing is believed to be most sensitive.
- *Positive Impulse.* This is the metric used to analyze lethal noise levels. Pounds per square inch per millisecond (psi-msec) are the units used to express this metric.
- *Peak Pressure.* The maximum positive pressure for an arrival of a noise pressure wave that a protected species would receive at some distance away from a detonation. Units used here are pounds per square inch (psi) and dB levels.

Criterion and Thresholds for Non-Injurious Harassment of Marine Mammals

The CHURCHILL criterion for (non-injurious) harassment is temporary (auditory) threshold shift (TTS), a slight, recoverable loss of hearing sensitivity (U.S. Navy, 2001). The criterion for Level B Harassment used in this document is the dual criterion of 182 dB re 1 μPa^2-s maximum EFD level in any 1/3 octave band at frequencies above 100 Hz for toothed whales (e.g. dolphins) and the 23 psi peak pressure. A 1/3 octave band above 10 Hz is used for impact assessments on baleen whales, which are not part of the affected environment of this project.

Criteria and Thresholds for Injury to Marine Mammals

Non-lethal injurious impacts are defined in this document as eardrum rupture (i.e., tympanic-membrane [TM] rupture) and the onset of slight lung injury. These are considered indicative of the onset of injury. The threshold for TM rupture corresponds to a 50 percent rate of rupture (i.e., 50 percent of animals exposed to the level are expected to suffer TM); this is stated in terms of an EFD value of 1.17 in-lb/in^2, which is about 205 dB re 1 μPa^2-s. This recognizes that TM rupture is not necessarily a life-threatening injury, but is a useful index of possible injury that is well correlated with measures of permanent hearing impairment (e.g., Ketten [1998] indicates a 30 percent incidence of permanent threshold shift [PTS] at the same threshold).

Risk Estimates

Methodology for Take Estimation

<u>Temporal and Spatial Variations:</u> The GulfCet II (1996-1997) aerial surveys identified different density estimates of marine mammals and sea turtles between the winter and summer seasons, as well as between the shelf and slope geographic locations.

Surface and Submerged Variations: The GulfCet II surveys focused on enumerating animals detected at the ocean surface and therefore do not account for submerged animals or animals missed by the observer. As such, GulfCet II surveys do not provide a relative density estimate for the entire potential population of any given species and are therefore negatively biased. To provide a more conservative impact analysis, however, density estimates have been adjusted to account for submerged individuals. The percent time that an animal is submerged versus at the surface was utilized to determine an adjusted density for each species. Percent time submerged for each species was obtained from Moore and Clarke (1998). Density estimates were adjusted to conservatively reflect the potential for undetected submerged animals.

Proposed Action Take Estimations

Table D-1. Marine Mammal Densities and Risk Estimates for Lethality (31 psi-ms) Noise Exposure for All In-Water and In-Air Detonations for the Proposed Action

Species	Density	Number of Animals Exposed from All In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Dwarf/pygmy sperm whale	0.013	0.004	0.003
Bottlenose dolphin	0.81	0.262	0.183
Atlantic spotted dolphin	0.677	0.219	0.153
T. truncatus/S. frontalis	0.053	0.017	0.012
TOTAL		**0.502**	**0.351**
Winter			
Dwarf/pygmy sperm whale	0.013	0.004	0.003
Bottlenose dolphin	0.81	0.262	0.183
Atlantic spotted dolphin	0.677	0.219	0.153
T. truncatus/S. frontalis	0.053	0.017	0.012
TOTAL		**0.502**	**0.351**

Table D-2. Marine Mammal Densities and Risk Estimates for Level A Harassment (205 dB EFDL 1/3-Octave Band) Noise Exposure for All In-Water and In-Air Detonations for the Proposed Action

Species	Density	Number of Animals Exposed from All In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Dwarf/pygmy sperm whale	0.013	0.014	0.010
Bottlenose dolphin	0.81	0.893	0.625
Atlantic spotted dolphin	0.677	0.747	0.523
T. truncatus/S. frontalis	0.053	0.058	0.041
TOTAL		**1.712**	**1.198**
Winter			
Dwarf/pygmy sperm whale	0.013	0.014	0.010
Bottlenose dolphin	0.81	0.893	0.625
Atlantic spotted dolphin	0.677	0.747	0.523
T. truncatus/S. frontalis	0.053	0.058	0.041
TOTAL		**1.712**	**1.198**

Table D-3. Marine Mammal Densities and Combined Risk Estimates for the 23 psi Peak Pressure and the 182 dB EFD 1/3-Octave Band Level B Harassment Metrics for All In-Water and In-Air Detonations for the Proposed Action

Species	Density	Number of Animals Exposed from In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Dwarf/pygmy sperm whale	0.013	0.26	0.182
Bottlenose dolphin	0.81	16.209	11.3463
Atlantic spotted dolphin	0.677	13.547	9.4829
T. truncatus/S. frontalis	0.053	1.061	0.7427
TOTAL		**31.076**	**21.7532**
Winter			
Dwarf/pygmy sperm whale	0.013	0.44	0.308
Bottlenose dolphin	0.81	27.387	19.1709
Atlantic spotted dolphin	0.677	22.89	16.023
T. truncatus/S. frontalis	0.053	1.792	1.2544
TOTAL		**52.509**	**36.7563**

Table D-4. Sea Turtle Densities and Risk Estimates for Lethality (31 psi-ms) Noise Exposure for All In-Water and In-Air Detonations under the Proposed Action

Species	Density	Number of Animals Exposed from All In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Loggerhead	0.617	0.200	0.140
Kemp's ridley	0.038	0.012	0.008
Leatherback	0.081	0.026	0.018
Unidentified chelonid	0.073	0.024	0.017
TOTAL		**0.262**	**0.183**
Winter			
Loggerhead	0.617	0.200	0.140
Kemp's ridley	0.038	0.012	0.008
Leatherback	0.081	0.026	0.018
Unidentified chelonid	0.073	0.024	0.017
TOTAL		**0.262**	**0.183**

Table D-5. Sea Turtle Densities and Risk Estimates for Level A Harassment (205 dB) Noise Exposure for All In-Water and In-Air Detonations under the Proposed Action

Species	Density	Number of Animals Exposed from All In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Loggerhead	0.617	0.681	0.477
Kemp's ridley	0.038	0.042	0.029
Leatherback	0.081	0.089	0.062
Unidentified chelonid	0.073	0.081	0.057
TOTAL		**0.893**	**0.625**
Winter			
Loggerhead	0.617	0.681	0.477
Kemp's ridley	0.038	0.042	0.029
Leatherback	0.081	0.089	0.062
Unidentified chelonid	0.073	0.081	0.057
TOTAL		**0.893**	**0.625**

Table D-6. Sea Turtle Densities and Combined Risk Estimates for the 23 psi Peak Pressure and the 182 dB EFD 1/3-Octave Band Level B Harassment Metrics for All In-Water and In-Air Detonations for the Proposed Action

Species	Density	Number of Animals Exposed from All In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Loggerhead	0.617	12.347	8.643
Kemp's ridley	0.038	0.760	0.532
Leatherback	0.081	1.620	1.134
Unidentified chelonid	0.073	1.461	1.023
TOTAL		**16.188**	**11.332**
Winter			
Loggerhead	0.617	20.861	14.603
Kemp's ridley	0.038	1.285	0.900
Leatherback	0.081	2.739	1.917
Unidentified chelonid	0.073	2.468	1.728
TOTAL		**27.353**	**19.147**

Table D-7. Marine Mammal Densities and Risk Estimates for Lethality (31 psi-ms) Noise Exposure for All In-Water and In-Air Detonations under Alternative 1

Species	Density	Number of Animals Exposed from All In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Dwarf/pygmy sperm whale	0.013	0.008	0.006
Bottlenose dolphin	0.81	0.524	0.367
Atlantic spotted dolphin	0.677	0.438	0.307
T. truncatus/S. frontalis	0.053	0.034	0.024
TOTAL		**1.004**	**0.703**
Winter			
Dwarf/pygmy sperm whale	0.013	0.013	0.009
Bottlenose dolphin	0.81	0.786	0.550
Atlantic spotted dolphin	0.677	0.657	0.460
T. truncatus/S. frontalis	0.053	0.051	0.036
TOTAL		**1.507**	**1.055**

Table D-8. Marine Mammal Densities and Risk Estimates for Level A Harassment (205 dB EFDL 1/3-Octave Band) Noise Exposure for All In-Water and In-Air Detonations under Alternative 1

Species	Density	Number of Animals Exposed from All In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Dwarf/pygmy sperm whale	0.013	0.066	0.046
Bottlenose dolphin	0.81	4.094	2.866
Atlantic spotted dolphin	0.677	3.422	2.395
T. truncatus/S. frontalis	0.053	0.268	0.188
TOTAL		**7.850**	**5.495**
Winter			
Dwarf/pygmy sperm whale	0.013	0.066	0.046
Bottlenose dolphin	0.81	4.094	2.866
Atlantic spotted dolphin	0.677	3.422	2.395
T. truncatus/S. frontalis	0.053	0.268	0.188
TOTAL		**7.850**	**5.495**

Table D-9. Marine Mammal Densities and Combined Risk Estimates for the 23 psi Peak Pressure and the 182 dB EFD 1/3-Octave Band Level B Harassment Metrics for All In-Water and In-Air Detonations under Alternative 1

Species	Density	Number of Animals Exposed from In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Dwarf/pygmy sperm whale	0.013	0.771	0.5397
Bottlenose dolphin	0.81	48.065	33.6455
Atlantic spotted dolphin	0.677	40.173	28.1211
T. truncatus/S. frontalis	0.053	3.145	2.2015
TOTAL		**92.154**	**64.5078**
Winter			
Dwarf/pygmy sperm whale	0.013	1.309	0.9163
Bottlenose dolphin	0.81	81.53	57.071
Atlantic spotted dolphin	0.677	68.143	47.7001
T. truncatus/S. frontalis	0.053	5.335	3.7345
TOTAL		**156.317**	**109.4219**

Table D-10. Sea Turtle Densities and Risk Estimates for Lethality (31 psi-ms) Noise Exposure for All In-Water and In-Air under Alternative 1

Species	Density	Number of Animals Exposed from All In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Loggerhead	0.013	0.599	0.419
Kemp's Ridley	0.81	0.037	0.026
Leatherback	0.677	0.079	0.055
Unidentified chelonid	0.053	0.071	0.050
TOTAL		**0.786**	**0.550**
Winter			
Loggerhead	0.013	0.599	0.419
Kemp's Ridley	0.81	0.037	0.026
Leatherback	0.677	0.079	0.055
Unidentified chelonid	0.053	0.071	0.050
TOTAL		**0.786**	**0.550**

Table D-11. Sea Turtle Densities and Risk Estimates for Level A Harassment (205 dB EFDL) Noise Exposure for All In-Water and In-Air Detonations under Alternative 1

Species	Density	Number of Animals Exposed from All In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Loggerhead	0.617	3.119	2.183
Kemp's Ridley	0.038	0.192	0.134
Leatherback	0.081	0.409	0.286
Unidentified chelonid	0.073	0.369	0.258
TOTAL		**4.089**	**2.862**
Winter			
Loggerhead	0.617	3.119	2.183
Kemp's Ridley	0.038	0.192	0.134
Leatherback	0.081	0.409	0.286
Unidentified chelonid	0.073	0.369	0.258
TOTAL		**4.089**	**2.862**

Table D-12. Sea Turtle Densities and Combined Risk Estimates for the 23 psi Peak Pressure and the 182 dB EFD 1/3-Octave Band Level B Harassment Metrics for All In-Water and In-Air Detonations under Alternative 1

Species	Density	Number of Animals Exposed from In-Air and In-Water Detonations	Adjusted Number Exposed Based on 30% Mitigation Effectiveness
Summer			
Loggerhead	0.617	36.613	25.6291
Kemp's Ridley	0.038	2.255	1.5785
Leatherback	0.081	4.807	3.3649
Unidentified chelonid	0.073	4.332	3.0324
TOTAL		**48.007**	**33.6049**
Winter			
Loggerhead	0.617	62.104	43.4728
Kemp's Ridley	0.038	3.825	2.6775
Leatherback	0.081	8.153	5.7071
Unidentified chelonid	0.073	7.348	5.1436
TOTAL		**81.43**	**57.001**

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APPENDIX E

PUBLIC REVIEW PROCESS

PUBLIC NOTIFICATION

In compliance with the National Environmental Policy Act, Eglin Air Force Base announces the availability of a Draft Environmental Assessment and Finding of No Significant Impact for RCS 03-489 Precision Strike Weapons (PSW) Test (Five-Year Plan) in the Eglin Gulf Test and Training Range (EGTTR) for public review and comment.

The Proposed Action of RCS 03-489, "PSW Test," would be for the U.S. Air Force Air Armament Center and U.S. Navy, in cooperation with the 46th Test Wing Precision Strike Branch to conduct a series of PSW test missions during the next five years utilizing resources within the Eglin Military Complex, including two sites in the Eglin Gulf Test and Training Range. The weapons to be tested are the Joint Air–to-Surface Stand-Off Missile (JASSM) and the Small-Diameter Bomb (SDB). As many as one live and four inert JASSM missiles, and six live and twelve inert SDBs per year would be launched from an aircraft above the Gulf of Mexico at a target located more than 16 nautical miles offshore of Eglin Air Force Base. The EGTTR encompasses Eglin controlled airspace overlying 124,031 square miles of the Gulf of Mexico waters.

Testing is anticipated to occur several times per year for five years beginning in October 2005. The tests would be conducted at two target locations; one located more than 16 Nautical Miles (NM) offshore of Destin and another located more than 25 NM offshore of Test Area D-3 at Cape San Blas near Port St. Joe, Fla.

Your comments on this Draft PSW Test EA are requested. Letters and other written or oral comments provided may be published in the Final PSW Test EA. As required by law, comments will be addressed in the Final PSW Test EA and made available to the public. Any personal information provided, including private addresses, will be used only to identify your desire to make a statement during the public comment period or to compile a mailing list to fulfill requests for copies of the Final PSW Test EA or associated documents. However, only the names and respective comments of respondent individuals will be disclosed: personal home addresses and phone numbers will not be published in the Final PSW Test EA.

Copies of the EA and FONSI may be reviewed at the Fort Walton Beach Public Library, 105 SE Miracle Strip Parkway, Fort Walton Beach, Fla., Destin Public Library, 150 Sibert Avenue, Destin, Fla., and Gulf County Public Library, 110 Library Road, Port St. Joe, Fla. Copies will be available for review from 27 August 2005 through 26 September 2005. Comments must be received by 29 September 2005.

For more information or to comment on these proposed actions, contact:

Mr. Mike Spaits, 96th Civil Engineer Group Environmental Public Affairs, 501 De Leon Street, Suite 101, Eglin AFB, Florida 32542-5133 or email: spaitsm@eglin.af.mil. Tel: (850) 882-2878 ext. 333; Fax: (850) 882-3761

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MEMO

28 November 2005

FROM: 96th CEG/CEV-PA

TO: 96th CEG/CEVSP

SUBJECT: **PUBLIC NOTICE "Precision Strike Weapons Test," Eglin AFB, Florida**

A public notice was published in the *Northwest Florida Daily News* on August 27th, 2005 to disclose completion of the Draft EA, selection of the preferred alternative, and request comments during the 30-day pre-decisional comment period.

The 30-day comment period ended on Sept. 26th, with the comments required to this office not later than Sept. 29th, 2005.

No comments were received during this period.

//SIGNED//
Mike Spaits
Public Information Specialist